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MEASURES, WEIGHTS and MONEYS

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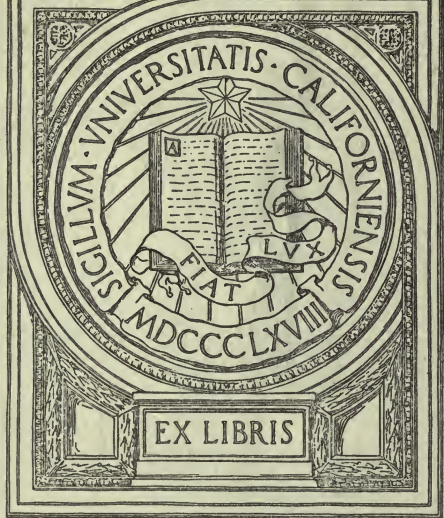

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MEASURES, WEIGHTS, AND MONEYS

OF ALL NATIONS

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MEASURES, WEIGHTS, & MONEYS

OF ALL NATIONS

AND AN ANALYSIS OF THE CHRISTIAN, HEBREW, AND MAHOMETAN CALENDARS

BY

W. S. B. WOOLHOUSE, F.R.A.S., F.S.S.

ETC.

Seventh Edition, carefully Revised and Enlarged

SCIENTIFICAL CLASSICS
SAN FRANCISCO

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PREFACE.

THE measures, weights, and moneys established throughout the world are so diversified in their comparative values and systematic relations that a correct classification of them is a task of greater magnitude than would commonly be supposed. In the present work no labour has been spared to ascertain, in every case, the best attainable information, and the various details have been arranged with especial regard to facility of reference. With this object the materials appertaining to each locality are uniformly tabulated in the same order, and opposite to each separate quantity or value the English equivalent is distinctly exhibited, so as to obviate as much as possible the necessity of any calculation.

The comprehensive principles which influence the fluctuations of exchange are also briefly stated, and correct rules are given for computing the sterling value of coins and bullion.

The tables for the conversion of the standard linear and square measures of one country into those of another were before published in another form, and had recently become out of print. They are here enlarged and more conveniently arranged, and their utility will be fully appreciated by those who may have occasion to consult the architectural and other works of the Continent.

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The second part of the volume relates to the measurement of time, and comprises a detailed investigation of the Christian, Hebrew, and Mahometan Calendars, with formulæ, tables, and practical rules for performing the various calculations. We have been more specially induced to go at length into these subjects, as they are imperfectly treated in chronological works generally.

PREFACE TO THE SEVENTH EDITION.

In revising this work for the seventh edition opportunity has been taken to make as many suitable emendations and additions as were possible. By means of the valuable Reports of the Board of Trade under the Weights and Measures Act, 1878, the author has been enabled to give, in an Appendix, the most reliable account of the Weights and Measures of China and Japan, which were formerly involved in much obscurity. Full and authentic information is given on the subject of Wire and Plate Gauges, and more especially in relation to the new Imperial Standard Wire Gauge which, in 1883, was legalised by an Order in Council. The chief particulars are also given of the new Weights and Measures Act, 1889; and the Appendix furthermore supplies a variety of miscellaneous and interesting information on other matters.

The utmost facility for detailed reference is also secured by the addition of a full and complete Index of the entire contents of the volume.

London, 12*th August*, 1890.

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MEASURES, WEIGHTS, AND MONEYS

OF

ALL NATIONS.

STANDARDS.

MEASURES AND WEIGHTS.

MEASURES are of three kinds, viz. measures of LENGTH, called Linear or Long measure; measures of SURFACE, called Square or Superficial measure; and measures of CAPACITY, called Solid or Cubic measure.

WEIGHT may be defined to be the quantity of ponderous matter contained in a solid or fluid substance, taking into account its bulk and the density or specific gravity of its parts, and is determined by the same being balanced in an accurate scale against some known or acknowledged weights placed in the opposite scale.

STANDARDS are carefully-constructed measures or weights of acknowledged authority, by which others are tested or adjusted.

Measures and Weights are of indispensable utility, and are continually employed both in commercial and scientific pursuits. For the latter of these, minute accuracy is particularly essential. There is, however, more difficulty than would at first be supposed, in establishing and preserving correct, uniform, and invariable standards of weights and measures, and a vast amount of scientific research, ingenuity, and labour has been expended upon its accomplishment.

The origin of measures of length is to be found in parts of the human body. Their values, roughly estimated, as well as their names, establish this beyond a doubt. The foot, the digit, the palm, the span, the cubit, the nail, the arm, &c., are in all languages derived from the same source; and, in the popular view of measurement, they do not considerably differ in length. It is also unquestionable that in former times, when authenticated measures were not so easily to be obtained, the hands, arms, and feet were much more frequently used than they are at present, when every workman, however humble, is in possession of a measure.

Taking a well-proportioned man, the fathom is reckoned to equal his height or stature; the girth, or the pace, $\frac{1}{2}$ of his stature; the cubit, or measurement from the elbow to the ends of the extended fingers, $\frac{1}{4}$; the foot, $\frac{1}{6}$; the span, $\frac{1}{8}$; and the breadth of the palm, $\frac{1}{24}$.

The statute 17 Edward II. (A.D. 1324) provides that three barley-corns, round and dry, make an inch, 12 inches a foot, &c. But it is so difficult to know how much of the sharp end of a barley-corn must be cut or worn away before it becomes what was called "round," that this mode of measuring by the *lengths* of barley-corns is very indefinite.

The complete table of the sixteenth century is as follows:— The *breadth* of 4 barley-corns make a digit, or finger-breadth; 4 digits make a palm (measured across the middle joints of the fingers); 4 palms are a foot; $1\frac{1}{2}$ foot is a cubit; 10 palms or $2\frac{1}{2}$ feet are a step (gressus); 2 steps, or 5 feet, are a pace (passus); 10 feet are a perch; 125 paces are an Italic stadium; 8 stadia, or 1000 paces, are an Italic mile; 4 Italic miles are a German mile; and 5 Italic miles are a Swiss mile. From this table it would appear that the foot was considerably less even than the ancient Roman foot of 11·6 English inches; the average human foot certainly has not that length.

In the year 1742, the Royal Society had a standard yard constructed, from a minute comparison of the standard ells

or yards of the reigns of Henry VII. and Elizabeth, kept at the Exchequer.

In the year 1758, a select Committee of the House of Commons was appointed to inquire into the state of English weights and measures, and were assisted in their researches by several eminent mechanists, among whom may be mentioned Mr. Bird, a celebrated optician, and Mr. Harris, the Assay Master of the Mint. This Committee prepared with great accuracy two standards, viz. the yard and the pound troy, which were afterwards carefully preserved and justly considered of the highest authority. The standard yard was copied from that of the Royal Society, and having been examined by the Committee was reported to be equal to the standard yard and marked as such.

Since that period no alteration has been made in these standards, though much attention has been paid to the subject, both in and out of Parliament, especially since the adoption of the metrical system of France.

In 1816, in consequence of an address from the House of Commons to the Prince Regent, his Royal Highness appointed a Commission, composed of Sir J. Banks, Sir G. Clerk, Davies Gilbert, Wollaston, Young, and Kater, to consider the subject of English weights and measures; to determine the length of the pendulum vibrating seconds in the latitude of London; and to settle the proportion between the long measures of England and France.

In the first Report, made in June, 1819, no alteration is proposed to be made in the English standards of long measure and of weight, those established by the Committee of 1758 having been found quite accurate.

The second Report, made in 1820, contains the final determination of the Commissioners on the standard of long measure, the length of the second's pendulum, and of that of the metre. The following are the concluding words of this decision:—

"We prefer the Parliamentary standard executed by Mr.

Bird, in 1760, both as being laid down in the most accurate manner, and as the best agreeing with the most extensive comparisons, which have been hitherto executed by various observers, and circulated throughout Europe; and in particular with the scale employed by the late Sir George Shuckburgh.

"We have, therefore, now to propose that this standard be considered as the foundation of all legal weights and measures; and that it be declared that the length of the pendulum vibrating seconds in a vacuum, on the level of the sea, in London, is 39·1393 inches, and that of the French metre, 39·37079 inches, the English standards being employed at 62° of Fahrenheit."

The third Report of the Royal Commission, made in 1821, contains a confirmation of the other two Reports, with respect to measures of length: and as to weights, the Parliamentary troy pound of 1758 is recommended to remain unaltered, and the pound avoirdupois to continue at 7000 troy grains. It is also announced, by new experiments, that a cubic inch of distilled water at 62° is 252·722 grains of the standard pound of 1758, when weighed in a vacuum.

The House of Commons again appointed a Committee in 1821, to which these Reports were submitted: this Committee agreed with the Commissioners, and a bill was introduced in 1823. A petition from the Chamber of Commerce at Glasgow to the House of Lords occasioned an investigation, when Dr. Kelly, as one of the witnesses before the Committee, called attention to certain difficulties and imperfections in the pendulum experiments, and expressed an opinion, supported by few others at the time, though now generally received, that "nature seems to refuse invariable standards; for, as science advances, difficulties are found to multiply, or at least they become more perceptible, and some appear insuperable." The House of Lords adjourned the question over till 1824; when the act 5 Geo. IV. c. 74, was passed. This act came into operation on January 1, 1826,

and made no change in the lineal and superficial measures, nor did it alter either the troy or avoirdupois weights previously established; but the measures of capacity underwent considerable change. The old Ale, Wine, and Dry measures were formerly the three authorized measures of capacity. The old Wine gallon contained 231 cubic inches; the Corn gallon, 268·8; and the old Ale gallon, 282. These measures were altered to the Imperial Gallon, containing 277·274 cubic inches.

The act also states that the pendulum vibrating seconds of mean time in the latitude of London in a vacuum at the level of the sea is 39·1393 inches of the standard; and that the cubic inch of distilled water, weighed in air by brass weights, at 62° of Fahrenheit, the barometer being at 30 inches, is equal to 252·458 grains, according to the brass weight or troy pound of 1758, declared to remain the original and genuine standard measure of weight.

Under this system, a gallon of water weighing 70,000 grains, or 10 lbs., it follows that

> "A pint of pure water
> Weighs a pound and a quarter;"

where, of course, reference is made to imperial measures and the avoirdupois pound.

The Houses of Parliament were burnt in 1834, and it is remarkable that 5 and 6 Wm. IV. c. 63, which passed after the fire, takes no notice of the destruction of the standards, but refers to them as still in existence.

It was, however, fortunate that in the year 1832 the council of the Royal Astronomical Society caused a scale of one yard to be constructed for themselves, and obtained permission of the Speaker of the House of Commons to adjust and compare it with Bird's Imperial Standard of 1760. This was accomplished in 1834 by an extensive set of delicate experiments, ably conducted by Mr. Baily and Lieutenant Murphy (since deceased); and, after the subsequent loss of the Imperial Standard, it may now, perhaps, be re-

ferred to as the only measure of length from which the standard scale of Great Britain can be satisfactorily deduced. The Astronomical Society's scale was also compared with the Royal Society's scale of 1742, having two scales in it marked E and Exch.; a scale called Aubert's, the prototype of one which was used in the Indian survey by Lambton; one which had been used by Sir G. Shuckburgh; one belonging to the town of Aberdeen; one belonging to Mr. T. Jones; and four new ones made after the model of the Society's scale—one for the Danish government, one for the Russian government, one for Mr. Baily, and one retained for himself by Mr. Simms the constructor. The middle yard of the Astronomical Society's scale being taken as 36 inches, the various scales, according to the mean of many observations, were found to be as follows:—

Scale.	Standard Portion.	Mean Inches of Ast. Soc. Scale.
Astron. Society	Centre yard	36·000000
Danish	Ditto	35·999758
Russian	Ditto	36·000050
Simms's	Ditto	35·999903
Baily's	Ditto	35·999949
Aberdeen	Ditto	35·998615
Jones's	Ditto	35·999802
Aubert's	0 in. — 36 in.	35·998447
Shuckburgh	0 in. — 36 in.	36·000185
Ditto	10 in. — 46 in.	35·999921
Royal Society	Line "E."	36·001473
Ditto	Line "Exch."	35·993684
Imperial standard of Bird's, of 1760, afterwards destroyed in 1834 by the burning of the Houses of Parliament		35 999624

Thus the Astronomical Society's standard being ·000376 longer than the Imperial standard, and the standard temperature being 62°, it follows that the length of the former standard, observed at 62°, and diminished by ·000376 of an inch, will give the true standard of the law.

In the year 1838, the Government appointed a Commis-

sion "to consider the steps to be taken for the Restoration of the Standards of Weight and Measure, which had been destroyed and lost by the burning of the Houses of Parliament." The members of this commission were Messrs. Airy, Baily, Bethune, Davies Gilbert, Herschel, Lefevre, Lubbock, Peacock, and Sheepshanks; and the following is extracted from their valuable report made in 1841:—

"We are of opinion that the definition contained in the act 5 Geo. IV. c. 74, ss. 1 and 4, by which the standard yard and pound are declared to be respectively a certain brass rod and a certain brass weight therein specified, is the best which it is possible to adopt.

"Since the passing of the said act, it has been ascertained that several elements of reduction of the pendulum experiments therein referred to, are doubtful or erroneous. Thus, the reduction to the level of the sea was doubtful, the reduction for the weight of air was erroneous, the specific gravity of the pendulum was erroneously stated, the faults of the agate plates introduced some degree of doubt, and sensible errors were introduced in the operation of comparing the length of the pendulum with Shuckburgh's scale, used as the representative of the legal standard. It is evident, therefore, that the course prescribed by the act would not necessarily reproduce the length of the original yard. It appears also, that the determination of the weight of a cubic inch of distilled water is yet doubtful, the greatest difference among the best English, French, Austrian, Swedish, and Russian determinations being about $\frac{1}{1200}$ of the whole weight, whereas the mere operation of weighing may be performed to the accuracy of $\frac{1}{10000000}$ of the whole weight.

"Several measures, however, exist, which were most accurately compared with the former standard yard (in particular the Royal Astronomical Society's Scale, described in their Memoirs, vol. ix., and the iron bars belonging to the Board of Ordnance, in the custody of Colonel Colby); and several metallic weights exist which were most accurately compared

with the former standard pound: and by the use of these the values of the original standards can be respectively restored without sensible error. And we are fully persuaded that, with reasonable precautions, it will always be possible to provide for the accurate restoration of standards, by means of material copies which have been carefully compared with them, more securely than by reference to any experiments referring to natural constants.

"From the evidence of persons best able to judge of the comparative use of troy weight and avoirdupois weight, the proportion does not exceed one set of troy weights to many thousand sets of avoirdupois. The statements of medical men and those of persons concerned in the trade of bullion, show that even to them the troy pound is useless. The avoirdupois pound, on the other hand, is universally known through this kingdom; and moreover, being now made equal to 7000 grains, it is well adapted to subdivision by the decimal scale,—an object which we think ought never to be placed out of view in considering the changes (in other respects producing no inconvenience) which may be made in the weights and measures of the country. We feel it our duty, therefore, to recommend that the *avoirdupois* pound be adopted instead of the *troy* pound as the standard of weight. With regard to the standard of length, we do not feel the necessity of proposing any change.

"That two modes of estimating weight should coexist, is undoubtedly an evil; its bad effects are greatly increased by the identity of the names used in the different scales for describing weights of very different values. Thus we have the *pound* in the avoirdupois scale, and the *pound* in the troy or apothecaries' scale, the former being *greater* than the latter in the proportion of 7000 to 5760; we have the *ounce* in the avoirdupois scale, and the *ounce* in the troy or apothecaries' scale, the former being *less* than the latter in the proportion of 7000 to 7680; we have the *dram* in the avoirdupois scale, and the *drachm* in the apothecaries' scale, the

former being *less* than the latter in the proportion of 7000 to 15,360. In examining into the actual uses of these several denominations, we see at once that it is impossible to abrogate the avoirdupois pound and ounce, which are used so extensively by persons of every class, that they must be considered as being emphatically the British weights. The avoirdupois dram, however, does not appear to be used at all. The troy pound, as we have already mentioned, appears to be wholly useless: it is not used in contracts for gold and silver, or in medical prescriptions; and we are not aware of any obstacle whatever to its entire abolition, except the existence of certain printed tables for the reduction of assays of the precious metals, in which the denominations of the larger weights are expressed by multiples of troy pounds. We propose, with the view of removing the confusion caused by the existence of this pound, and at the same time of respecting the private interests which (though to a very inconsiderable extent) are concerned in the change, that the Government should compute and print, for the use of bullion merchants and assayers, a new edition of these tables, in which the larger weights shall be expressed by decimal multiples of the troy ounce, to the entire exclusion of the troy pound. We are inclined to think that the troy ounce itself could not be abolished at present without some difficulty; we think it right, however, that the persons using it should be imperatively required to describe it in such a manner that no confusion with the avoirdupois ounce can possibly occur. The remaining weights of the troy and apothecaries' scales may, for the present, be tolerated (for certain substances only), as leading to no ambiguity. Still we think it desirable, that measures should now be taken which may ultimately tend to the removal of the troy scale; and remarking both the convenience of a decimal scale of subdivision of the avoirdupois pound, and the general willingness of bullion merchants to adopt a decimal scale, and remarking also, that by descending in such a scale we arrive at a small weight (7 grains), bearing

a simple relation to the grain on which the troy weight is based, we propose that the Government should use its influence for the introduction of such decimal scale.

"We beg leave to invite the attention of the Government to the advantage and the facility of establishing in this country a decimal system of coinage. In our opinion, no single change, which it is in the power of a Government to effect in our monetary system, would be felt by all classes as equally beneficial with this, when the temporary inconveniences attending the change had passed away. The facility consists in the ease of interposing between the sovereign (or pound) and the shilling, a new coin equivalent to two shillings (to be called by a distinctive name); of considering the farthing (which now passes as the $\frac{1}{960}$th part of the pound) as the $\frac{1}{1000}$th part of that unit; of establishing a coin of value equal to $\frac{1}{100}$th part of the pound; and of circulating, besides the principal members of a decimal coinage, other coins of values bearing a simple relation to them, including coins of the same value as the present shilling and sixpence. We do not feel ourselves at liberty further to enter into this subject; but we have felt it imperative on us to advert to it, because no circumstance whatever would contribute so much to the introduction of decimal scale in weights and measures, in those respects in which it is really useful, as the establishment of a decimal coinage."

The report contains also the following recommendations:—"That the standard of length be defined by the whole length of a certain piece of metal or other durable substance, supported in a certain manner, at a certain temperature; or, by the distance between two points or lines engraved upon the surface of a certain piece of metal or other durable substance, supported in a certain manner, at a certain temperature: but that the standard be in no way defined by reference to any natural basis, such as the length of a degree of meridian on the earth's surface in an assigned latitude, or the length of the pendulum vibrating seconds in a specified place.

"That the length of the new Parliamentary standard be *one* yard; there appearing no sufficient reason for departing from the length hitherto adopted for the standard.

"That the name *milyard*, or some other to be fixed by act of Parliament, be recognized as describing the measure of 1000 yards, without the necessity of further definition.

"That the standard of weight be defined by a certain piece of metal or other durable substance.

"That the standard of capacity be defined by the capacity which, under certain circumstances of the barometer and thermometer, contains a certain weight of distilled water, but that it be in no way defined by reference to the standard of length. That, nevertheless, the contents of the standard of capacity, as expressed in units and fractions of the cubical measure dependent on the standard of length, be stated by way of recital, as the best determination made by scientific men which has come to the knowledge of the Legislature, and as permitted for use when it is impracticable to refer to trial by the weight of distilled water.

"That no standard of capacity be constructed; the definition of the gallon as 'the capacity which contains 10 pounds' weight of distilled water weighed in air at the temperature of 62° Fahrenheit, the barometer being at 30 inches,' as specified in the act 5 Geo. IV., being still retained.

"That where it shall be impracticable to ascertain the contents of any vessel by the weight of distilled water which it contains, or by pouring water into it from a standard measure, it be permitted to ascertain the contents by gauging (the gallon being assumed to be 277·274 cubic inches), or by pouring seed into it from a standard measure.

"That a sufficient number of weights of multiples of grains be constructed (we would recommend 10 sets of 10, 100 and 1000 grains); and that their relative errors be found by comparison among themselves, and their absolute errors by comparison with the copies of the old troy pound of 5760 grains.

"That by the use of these, a platinum weight of 7000 grains be constructed; and that this be declared the Parliamentary standard of weight, by the name of the pound weight; the distinctive word 'avoirdupois' being hereafter omitted.

"That the avoirdupois dram be no longer recognized in any contract.

"That the troy pound be no longer recognized; and that the word 'pound,' or any letters or symbols commonly used to denote the pound, as applied to a weight, be always interpreted to mean the pound of 7000 grains (formerly called the avoirdupois pound).

"That the word 'ounce' be always interpreted to mean $\frac{1}{16}$th part of the pound, except it be described as the 'troy ounce.'

"That the name *millet*, or some other to be fixed by act of Parliament, be recognized as describing the thousandth part of the pound, without the necessity of further definition.

"That the only legal weights above one pound, be weights of multiples of 1 pound not exceeding 10 pounds; and weights of 10 pounds and its multiples, not exceeding 100 pounds.

"That the name *centner*, or some other to be fixed by act of Parliament, be recognized as describing the weight of 100 pounds, without the necessity of further definition.

"That the Exchequer standards of weight be 1 lb. and several multiples thereof, not exceeding 10 lbs.; 10 lbs. and several multiples thereof, not exceeding 100 lbs.; 100 lbs.; but no weight of 14 lbs. or any multiple of 14 lbs. except 70 lbs. Also the tenth, hundredth, and thousandth part of the pound, and several multiples of them. Also 1 troy ounce, 10 troy ounces, 100 troy ounces, and several multiples of each; 1000 troy ounces; but no weight of 12 troy ounces or any of its multiples (except those included in the decimal scale above described). Also 1 pennyweight, and several multiples of it. Also 1 grain, 10 grains, 100 grains, 1000 grains, 10,000 grains, and several multiples of each.

"That the Exchequer standards of weight be used in the trial of weights brought for examination in the same manner as at present; and that no greater error than $\frac{1}{20,000}$th part of the quantity weighed be tolerated.

"We would recommend that the influence of the Government be employed to introduce the use of the decimal subdivisions of the acre; of which the first step is actually given by the square land-chain, and the others are contained in the numerical expression obtained in the first multiplication for finding the area of a piece of ground.

"Before leaving the subject of length-measures, we beg strongly to call the attention of Government to the importance of encouraging the use of the decimal scale, and especially of sanctioning its use where custom has already adopted it. We beg particularly to indicate the decimal subdivision of the foot (which is even now engraved on foot rules and levelling staves), as one extensively used in the practice of engineers, and one which we would recommend for the recognition of Government in every case."

Although the preceding recommendations of the Commission have not been carried out they are here inserted, as the subject is very important and worthy of being generally understood.

It is probable that the varieties of gallons arose from the varieties of pounds, since the original definition of the gallon depended upon the pound, and there is a close relation not only between the old gallons and the weights, but even between the different versions of the old gallons and the weights. There was a gallon of 282 cubic inches in the Exchequer as a standard; there was one of $272\frac{1}{4}$ inches in common use; there was one of 231 inches in common use; and there was one of 224 inches in the Guildhall. Now 282 and 232 are, as near as integers can represent it, in the proportion of the pound avoirdupois to the pound troy; and $272\frac{1}{4}$ and 224 are as nearly in the same proportion. It is unlikely that this should have been accidental.

The imperial weights and measures now in use are fixed by the act 5 Geo. IV. c. 74, of which the following is an abstract.

Abstract of an Act of Parliament, 5 *Geo. IV. c.* 74, *passed June* 17, 1824, "*for ascertaining and establishing Uniformity of Weights and Measures*," *which came into operation on the* 1*st of January*, 1826.

This is an act declaratory of the accuracy and legality of the existing standards, both of long measure and weight; but it orders the abolition of all measures of capacity for wine, ale, corn, coals, &c., and the establishment of one only in their stead, which is to be called "Imperial Measure."

1. The standard yard is declared to be the distance between the centres of the two points on the gold studs in the straight brass rod now in the custody of the Clerk of the House of Commons, whereon is engraved "Standard Yard, 1760," the brass being at the temperature of 62° by Fahrenheit's thermometer. It is to be called "the Imperial Standard Yard."

2. The dimensions for measuring land are unaltered: they are the statute measure, of which the acre contains 4840 square yards.

3. The yard, if lost, defaced, or otherwise injured, may be restored by comparing it with the pendulum vibrating seconds of mean time, in the latitude of London, in a vacuum on the level of the sea, the yard being in the proportion of 36 inches to 39·1393 of the pendulum.

4. The standard pound is declared to be the standard brass weight of one pound troy weight made in the year 1758, and now in the custody of the Clerk of the House of Commons, and it is denominated "the Imperial Troy Pound."

5. If the imperial pound be lost, defaced, or otherwise

injured, it shall be restored by comparison with a cubic inch of distilled water, weighed in air by brass weights, at the temperature of 62° of Fahrenheit's thermometer, the barometer being at 30 inches. Such cubic inch of water is equal to 252·458 grains, the standard troy pound being 5760 such grains; and the avoirdupois pound 7000 such grains troy. All operations of restoring or correcting standards are to be made under the directions of the Lord High Treasurer, or the Commissioners of His Majesty's Treasury, or any three of them for the time being.

6. The standard measure of capacity, as well for liquids as for dry goods, not measured by heaped * measure, shall be the gallon, containing 10 lbs. avoirdupois weight of distilled water, weighed in air at the temperature of 62° of Fahrenheit's thermometer, the barometer being at 30 inches; and such brass measure shall be "the Imperial Standard Gallon," and is declared to be the unit and only standard measure of capacity from which all other measures of capacity for all sorts of liquids, as well as for dry goods not measured by heaped * measure, shall be derived; and that all measures shall be taken in parts and multiples, the quart, pint, peck, bushel, and quarter continuing in the same proportion as heretofore for dry measure.

7. That the standard measure of capacity for coals, culm, lime, fish, potatoes, or fruit, and all other goods and things commonly sold by heaped * measure, shall be the imperial bushel, containing 80 lbs. avoirdupois of water as aforesaid; the same being made round, with a plain and even bottom, and being 19½ inches from outside to outside.

8. That coals and other goods sold by heaped * measure shall be duly heaped up in the said bushel in the form of a cone, such cone to be of the height of at least 6 inches; and the outside of the bushel to be the extremity of the base of

* Heaped measures have been abolished since 1st Jan. 1835 (4, 5, and 6 Will. IV. c. 49 and 63).

such cone; and that three bushels shall be a sack, and twelve such sacks a chaldron.

9. That for articles not sold by heaped * measure, such as corn, pulse, &c., the same shall be stricken with a round stick or roller, straight, and of the same diameter from end to end.

10. That this law of imperial measure is not to extend to Ireland for any articles hitherto sold by weight.

11. That copies and models of the standard of length, weight, and measure aforesaid, are to be made and verified within three months after passing the act, under the direction of the Lords of the Treasury; and that such copies or models shall be deposited in the office of the Chamberlain of the Exchequer at Westminster; and that copies shall be sent to the Lord Mayor of London, and the Chief Magistrate of Edinburgh and of Dublin, and to such other places or persons as the Lord High Treasurer or Commissioners of the Treasury may from time to time direct.

12. That His Majesty's justices of the peace, in every county of the British Empire, or every town or place, being a county within itself, shall, within six months after passing the act, purchase a model of each of the standards aforesaid, with their parts and multiples; and that such shall be compared and verified with the models deposited at the Exchequer, on payment of the usual fees; and that such verified copies shall be placed for custody and inspection with such persons as the magistrates shall choose to appoint; and that the same shall be produced by the keepers thereof, upon reasonable notice, the persons requiring such production paying the customary charges for the same.

13. The expenses of procuring models for magistrates, counties, &c., are to be raised by the usual modes of taxation.

14. That when reference cannot be easily had to verified copies of the standard measures of capacity, it may be lawful for any justice of the peace, or magistrate having jurisdiction, to ascertain the content of a measure of capacity, by direct

reference to the weight of pure or rain water which such measure is capable of containing; 10 lbs. avoirdupois weight of such water, at the temperature of 62° by Fahrenheit's thermometer, being the standard gallon ascertained by the act, the same being in bulk equal to 277·274 cubic inches.

15. That all contracts for sale, &c., by weight or measure, shall be according to the imperial standard, when no special agreement shall be made to the contrary; and in all cases where any special agreement shall be made, with reference to any weight or measure established by local custom, the proportion which every such local weight or measure shall bear to any of the said standard weights and measures, shall be expressly declared and specified, or otherwise such agreement shall be null and void.

16. That existing measures may be used, being marked so as to show the proportions which they have to the imperial measures; but that after the 1st of May, 1825, no person shall be permitted to make any weights or measures, otherwise than according to the provisions of the new act.

17. That for ascertaining rents, &c., payable in grain or malt in England or Ireland, the amount is to be ascertained according to the standard by this act established, by a jury of 12 substantial freeholders.

18. That for ascertaining rents, &c., payable in grain or malt in Scotland, such rents shall be determined according to the new standard, by such juries as strike the fiar prices of grain.

19. That tables of equalization shall be made and constructed under the Commissioners of the Treasury, showing the proportions between the weights and measures heretofore in use and those now established.

20. That tables shall be also constructed for the collection of the customs and excise, under the direction of the said Commissioners of the Treasury.

21. The present act may be enforced in England and

Scotland by all the regulations and penalties contained in the following statutes, except such parts of the said statutes as may be repealed or altered by this present act, viz. 29 Geo. II. c. 25; 31 Geo. II. c. 17; 35 Geo. III. c. 102; 55 Geo. III. c. 43.

22. The present act may be enforced in Ireland by all the regulations and penalties contained in the following statutes, except such parts of the said statutes as are repealed or altered by this act, viz. 4 Anne (*I.*); 11 Geo. II. (*I.*); 25 Geo. II. (*I.*); 27 Geo. III. (*I.*); 28 Geo. III. (*I.*)

23. The repeal of numerous laws is declared in this article; some of uncertain date before the reign of Edward the Third, and many since that period. These are chiefly statutes which fixed the weight and measure of certain kinds of goods, such as wool, cheese, salt, wine, beer, fish, fruit, &c.; and also the denominations which determine their quantity, as the sack, wey, load, tun, hogshead, barrel, &c. For the particulars of these statutes (which are now repealed either wholly or in part), recourse must be had to the originals, as referred to in the margin of the present act, and which amount to about 60 statutes.

24. That this act shall not extend to affect or alter the rights of the Dean and High Steward of Westminster, to appoint proper officers to sign and seal all weights and measures used in the said city and the liberties thereof.

25. That gaugeable liquors brought into the port of the city of London shall be gauged as heretofore by the Lord Mayor or his deputies; but the contents shall be ascertained by the standard measure directed by this act.

26. This act shall not extend to prohibit or diminish the right of the Lord Mayor and Commonalty of the city of London, concerning the office of gauger of any gaugeable liquors imported within the city of London, or the liberties thereof.

Numerical relations appertaining to the foregoing Act for equalizing Measures.

Weight of a cubic inch of distilled water, in a vacuum at the temperature 62° = 252·722 grains.

Consequently, a cubic foot = 62·3862 lbs. avoirdupois.

Weight of a cubic inch of distilled water in air at 62° of temperature with a mean height of the barometer = 252·458 grains.

Consequently, a cubic foot = 62·3206 lbs. avoirdupois.

And an ounce of water = 1·73298 cubic inches.

Cubic inches in the imperial gallon = 277·274.

Diameter of the cylinder, containing a gallon at one inch in depth = 18·78933 inches.

Specific Gravity of Water at different temperatures, that at 62° being taken as unity.

70°	0·99913	61°	1·00010	52°	1·00076	43°	1·00109
69	0·99925	60	1·00019	51	1·00082	42	1·00111
68	0·99936	59	1·00027	50	1·00087	41	1·00112
67	0·99947	58	1·00035	49	1·00091	40	1·00113
66	0·99958	57	1·00043	48	1·00095	39	1·00113
65	0·99969	56	1·00050	47	1·00099	38	1·00113
64	0·99980	55	1·00057	46	1·00102	37	1·00112
63	0·99990	54	1·00064	45	1·00105	36	1·00111
62	1·00000	53	1·00070	44	1·00107	35	1·00109

The difference of temperatures between 62° and 39°, where water attains its greatest density, will vary the bulk of a gallon of water rather less than the third of a cubic inch.

And assuming from the mean of numerous estimates the expansion of brass 0·00001044 for each degree of Fahrenheit's thermometer, the difference of temperatures from 62° to 39° will vary the content of a brass gallon measure just one-fifth of a cubic inch.

It appears that the specific gravity of clear water from the Thames exceeds that of distilled water at the mean tem-

perature, in the proportion of 1·0006 to 1, making a difference of about one-sixth of a cubic inch on a gallon.

Rain water does not differ from distilled water, so as to require any allowance for common purposes.

Comparisons of Old and New Measures.

The foregoing calculation of the diameter of a cylinder, which contains 1 gallon for every inch in depth, will be found useful in constructing both corn and coal bushels on the new plan of imperial measure.

Thus the corn bushel, with the diameter 18·78933, and 8 inches deep, will answer to 2218·192 cubic inches, the imperial bushel; being about $\frac{1}{32}$ part more than the Winchester bushel, which is 2150·42 cubic inches.

The new coal bushel, with the above diameter and depth, and heaped as directed in Art. 8, the rim being about $\frac{3}{5}$ of an inch thick, and the diameter $19\frac{1}{2}$ inches from outside to outside, will measure 2816·459 cubic inches, which is only $1\frac{1}{2}$ inch more than the present coal bushel, viz. 2814·9 cubic inches.

The proportion between the old and new wine measures is very nearly as 5 to 6. Thus 5 imperial gallons equal 6 wine gallons and about $\frac{1}{4500}$ of a gallon over.

The proportion between the old and new ale measures is about as 60 to 59.

The following table will show the relative contents more accurately, both in measure and in weight, the latter having been computed according to the principles stated in the act.

Table showing the Contents of the different Gallons, both in Measure and Weight.

	Cubic Inches.	Avoirdupois Weight.			Troy Weight.			
		lb.	oz.	dr.	lb.	oz.	dwt.	gr.
Imperial Gallon. .	277·274	10	0	0	12	1	16	16
Corn Gallon . . .	268·8	9	10	$13\frac{3}{4}$	11	9	7	12
Wine Gallon. . .	231	8	5	$6\frac{1}{4}$	10	1	9	22
Ale Gallon . . .	282	10	2	$11\frac{1}{2}$	12	4	6	8

These results will be found useful in comparing different vessels where gauging cannot be relied on; and although they are computed according to the conditions of temperature, &c., as stated in Art. 6, yet the proportions will answer with sufficient correctness for all common purposes of business, with any kind of fresh water; but where great accuracy is required, it may be determined at any other temperature by means of the table given on page 19. Thus to find the weight of the wine gallon at 56° Fahrenheit, multiply its weight at 62°, viz. 8·3311 by 1·0005, and the result will be 8·3353, the required weight.

The reduction of the different measures may be easily computed by means of *factors* or multipliers, given in the following table:—

Table of Factors, for converting Old and New Measures.

	By Decimals.			By Fractions.		
	Corn Measure.	Wine Measure.	Ale Measure.	Corn Measure.	Wine Measure.	Ale Measure.
To convert Old Measures into New .	·96943	·83311	1·01704	$\frac{32}{33}$	$\frac{5}{6}$	$\frac{62}{61}$
To convert New Measures into Old .	1·03153	1·20032	·98324	$\frac{33}{32}$	$\frac{6}{5}$	$\frac{61}{62}$

Example I.—Reduce 63 gallons wine measure to imperial measure.

$63 \times \cdot 83311 = 52 \cdot 486$; or $63 \times \frac{5}{6} = 52\frac{1}{2}$ imperial gallons nearly.

Example II.—Reduce 8 bushels imperial measure to Winchester measure.

$8 \times 1 \cdot 03153 = 8 \cdot 25224$; or $8 \times \frac{33}{32} = 8\frac{1}{4}$ Winchester bushels nearly.

It should be observed, that the computations by the frac-

tions are only approximative, but they will be found sufficiently correct for most purposes.

In 1870 the Standards Commission, in connection with the Standard Weights and Measures Department of the Board of Trade, made the following important recommendation in their Fourth Report:—

"That mural or public standards of length be securely fixed for public use in all populous towns, and the expenses connected with them be defrayed from the local funds. The local authorities to be responsible for keeping them in good order, and the local inspectors to report to them periodically on their condition. These public standards not to be valid for convictions of false or defective measures."

In pursuance of this recommendation, measures of 100 feet, and of the chain of 66 feet, with their subdivisions, were laid down on the north side of Trafalgar Square, and these were legalised as secondary standards of length by Her Majesty's Order in Council, dated 27th June, 1876, wherein it is pointed out that by the 1st section of "The Standards of Weights, Measures, and Coinage Act, 1866," the custody of the imperial standards of length and of weight, &c., was transferred to the Board of Trade. The following condensed account, appertaining to the laying down of these secondary standards, has been extracted from an Appendix to the Annual Report, 1875-76, of H. W. Chisholm, Warden of the Standards.

The exhibition of public and mural standards of length in populous places throughout the country, was considered by the Commission for Restoration of the Standards to be one of the best auxiliary means for attaining and maintaining uniformity in the measures of length used by the public, and was recommended by the Commission in their Reports of 1841 and 1854. Similar recommendations were made by the Standards Commission appointed in 1867; and the mode in which they proposed such recommendations should be carried out by the Standards Department in laying down

public standards of the chains of 100 feet and of 66 feet, and erecting public standards of the yard and its principal parts.

In selecting a site for such public standards, the Commission expressed their opinion that they should be placed—

Where they are easily accessible to the public who may wish to compare their measures ;

Where such comparisons may be made without being disturbed by passers or idle gazers ;

Where sufficient protection from wilful damage may at all times be secured ;

And where there is a long and level plot of ground upon which the longer standard measures may be laid down, with an adjacent wall for the mural standards.

It was not until the spring of 1875 that the site of the north side of Trafalgar Square was obtained from the Office of Works, through the intervention of the Astronomer Royal. A working plan for the construction of these public standards was laid before the Standards Commission by the Astronomer Royal, which had been prepared by his son, Mr. Wilfrid Airy, an able practical civil engineer, whose valuable services were retained for making the working drawings, as well as for superintending the work of constructing the platform and laying down the standards. Mr. W. Airy also gave his assistance to the officers of the Standards Department in the work of comparing the standard chains when laid down, and in superintending the subsequent adjustment of some of the bronze blocks on which the defining lines were cut. All the blocks for defining the several measures are of bronze. Those inlaid in the granite are slightly conical, and are secured by cement in somewhat larger conical holes in the granite. The mural standard measures are also of bronze, securely fastened by screws to a solid frame. This frame, and those containing the descriptive tablets, are of bronze, and are secured to the granite wall by screws, the heads of which have since been removed to the level of the adjoining metal.

The mode in which the metal blocks bearing the defining lines of the standard measure of 100 feet were laid down, was by first marking out the several lengths by means of 10 of the pine 10-feet measuring-rods of the Standards Department, having subdivisions of 1 foot each marked upon them. Square holes were next cut in the granite in a marked-out straight line to receive the metal blocks, and were made sufficiently large to admit of a slight adjustment of the blocks in the direction of the length of the measure. When all was prepared, the square metal blocks for the 100-feet chain were placed in the several holes, and were embedded in cement, being secured on each side by an iron wedge. Each length was then carefully measured with the pine measuring-rods, and every requisite adjustment made, after which the surface of the cement was levelled and finished off.

A similar course was pursued with the whole length of the 66-feet chain, and with half of the whole length, the measurements being made with six of the 10-feet pine measuring-rods, and with two of the similar 3-feet measuring-rods of the Standards Department. The intermediate lengths of 10 links, each 7·92 inches, were laid down by using two 10-link measuring-rods of Messrs. Troughton & Simms, the intervals of each half-chain being adjusted so as to be as nearly equal as possible.

The definitive comparisons of the two measures of length were made with the two standard 10-feet measuring-bars, and the 6-feet bar constructed expressly for verifying continuous length measurements of this kind.

The errors of these two standard bars at 62° Fahr. have been determined, as follows:—

Standard 10-feet end-bar No. 1 . . .	·006739 in excess.
„ „ „ No. 2 . . .	·005919 „
The two bars	·012658 „
And 100 feet measured with them . .	·063290 „

The standard 6-feet steel end-bar is similar in its construc-

tion to the two 10-feet standard bars. Its standard length at 62° F. has been determined to be ·00691 inch in excess.

The mean results of two series of minute comparisons may be taken as the determined standard length at 62° F. of the several 10-feet subdivisions of the standard 100-feet measure from the zero block, viz. :—

Ascertained Errors of the several 10*-feet Subdivisions of the Standard* 100*-feet Measure from the Zero Block, measured to the middle of the defining line :—*

0—10 feet	− ·007 inch.	0—60 feet	+ ·007 inch.
20 „	− ·019 „	70 „	+ ·011 „
30 „	− ·022 „	80 „	+ ·021 „
40 „	− .015 „	90 „	+ ·017 „
50 „	− ·008 „	100 „	− ·008 „

All these errors are within the breadth of the several defining lines.

The surveyors' chain of 66 feet is divided into 100 links, each being 7·92 inches in length. The standard 66 feet now laid down is divided into 10 lengths of 10 links each. The only practical mode of verifying all these lengths was to compare the whole distance of 66 feet with the standard 10-feet steel bars carried successively along it for 60 feet, and completing the measurement with the standard 6-feet bar. The mean result of two series of minute observations may be taken as the determined standard length, viz.—

Ascertained error of standard chain of 66 feet at 62° F.= — ·019 inch.

A comparison was also made of each of the 10-link divisions of the 66-feet chain, with the two pine measuring-rods of 10 links each of Mr. Simms, in order to test any relative difference between them, and in this manner to verify the length of each, with reference to the relation of the sum of the 10 links to the whole length of the 66-feet chain. It was thus ascertained that the whole distance of 66 feet was accurately divided into 10 equal parts of 10 links each, within half the breadth of the defining lines.

The several mural standards of length, consisting of bed measures of the imperial yard of 3 feet, of 2 feet, of 1 foot, and of the line divisions of these measures, including those of 1 inch divided into tenths, have been accurately compared, and found to have no sensible error at the normal temperature of 62° F.

In France the new Metric System of measures, now completely established, was introduced in 1799, and is called metrical, as derived from the measurement of the earth. Its fundamental measure, the *metre*, is presumed to be the ten-millionth part of a meridian line drawn from the pole to the equator, and is 39·37079 English inches. Taking the one-hundredth of the metre, we obtain the *centimetre;* and for the standard of weight the *gramme* is a cubic centimetre of distilled water at the temperature of maximum density, the same being ·0022054 of an English avoirdupois pound, or 15·438 English grains. All the multiples and subdivisions of the current coins, as well as of every measure and weight, are decimal, full details of which will be found under the article "France." The advantage of such a system, when once established, is so great, that all who are capable of appreciating its merits look forward with interest to the introduction of a similar one into Great Britain. It has already been adopted in Austria, Belgium, Greece, Holland, Germany, Italy, Norway, Portugal, Spain, Sweden, and Switzerland.

The Weights and Measures Act, 1878 (41 & 42 Vict. cap. 49), came into operation on the 1st of January, 1879. By it all previous Acts are for the most part repealed. It is enacted,—

That the Board of Trade shall have all such powers and perform all such duties relative to standards of measure and weight, and to weights and measures, as are by any Act or otherwise vested in or imposed on the Treasury, or the

Comptroller-General of the Exchequer, or the Warden of the Standards. It shall be the duty of the Board of Trade to conduct all such comparisons, verifications, and other operations with reference to standards of measure and weight, in aid of scientific researches, or otherwise, as the Board of Trade from time to time thinks expedient, and to make from time to time a report to Parliament on their proceedings and business under this Act.

The Board of Trade shall cause to be compared with the Board of Trade standards all copies of any of those standards which are submitted for the purpose by any local authority, and have been used, or are intended to be used, as local standards, and, if approved, shall cause them to be stamped as verified in such manner as to show the date of such verification.

A contract or dealing shall not be invalid on the ground that the weights or measures used therein are weights or measures of the metric system, or on the ground that decimal subdivisions of imperial weights and measures, whether metric or otherwise, are used.

The Board of Trade also possess accurate copies of metric standards, and may, if they think fit, cause to be compared with the metric standards in their custody, and verified, all metric weights and measures, which are submitted to them for the purpose, and are of such construction as may be from time to time directed, and which the Board of Trade are satisfied are intended to be used for the purpose of science or of manufacture, and not for the purpose of trade within the meaning of this Act.

The following is a list of the standards in the custody of the Board of Trade at the passing of this Act :—

Measures of Length.

Feet: 100, 66, 16½, 10, 6, 5, 4, 3, 2, 1.

And 1 inch divided into { 12 duodecimal / 10 decimal / 16 binary } equal parts.

Measures of Capacity.

Bushel, half-bushel, peck,
Gallon, half-gallon,
Quart, pint, half-pint,
Gill, half-gill, quarter-gill.

Measures used in the Sale of Drugs.

Fluid ounces: 4, 3, 2, 1.
,, drachms: 4, 3, 2, 1.
Minims: 30, 20, 10, 5, 4, 3, 2, 1.

Avoirdupois Weights.

Pounds: 56, 28, 14, 7, 4, 2, 1. Ounces: 8, 4, 2, 1.
Drams: 8, 4, 2, 1, ½. Grains: 240, 120, 72, 48, 24.

Troy Bullion Weights.

Ounces: 500, 400, 300, 200, 100, 50, 40, 30, 20, 10, 5, 4, 3, 2, 1.
Decimals: ·5, ·4, ·3, ·2, ·1, ·05, ·04, ·03, ·02, ·01, ·005, ·004, ·003, ·002, 001.

Decimal Grain Weights.

Grains: 4,000, 2,000, 1,000, 500, 300, 200, 100, 50, 30, 20, 10, 5, 3, 2, 1, ·5, ·3, ·2, ·1, ·05, ·03, ·02, ·01.

Metric Measures and Weights.

1. Length. Metres: 2, 1, ·1, ·01, ·001.
2. Weights. Kilograms: 20, 10, 5, 2, 1.
Grams: 500, 200, 100, 50, 20, 10, 5, 2, 1.
Decigrams: 5, 2, 1. Milligrams: 5, 2, 1, ·05.
3. Capacity. Litres: 20, 10, 5, 2, 1, ·5, ·2, ·1, ·05, ·02, ·01, ·005, ·002, ·001.

COINS.

Coins are pieces of metal, mostly of a round and flat shape, stamped by authority with certain impressions, which are intended to give them a legal and current value, and also to serve as a guarantee for their weight and fineness.

Gold and silver are the principal metals of which coins are made, being found the fittest for that purpose, both on account of their qualities and their scarcity.

Copper and billon are likewise used, but always for coins of inferior value.

The proportional value of gold and silver is variable; for

although they are generally considered as equivalents of other property, and standard measures of value by which commodities are bought, sold, and estimated, yet, being themselves also saleable articles, they are liable to constant fluctuation in price, as exchanged for each other, as well as with respect to all property.

Pure gold and silver are invariable in their qualities, from whatever mines they are produced. In their fine state they are considered too flexible to make coins fit for general wear; and hence the practice of mixing with them a certain proportion of harder metal, which is called *alloy*.

The coinage of William the Conqueror was after the plan established by Charlemagne, in France, in the eighth century, and is supposed to be derived from the Romans, with respect to dividing the pound into 20 shillings and the shilling into 12 pence.

The Saxon pound weight was adopted by King William, and was called the moneyer's pound; and from it 20 shillings were coined, which made $21\frac{1}{3}$ to the pound troy. This number was increased in succeeding reigns until the year 1665 (18th Charles II.), at which time it was settled at 62 shillings, and so continued until the year 1816, when it was altered to 66 shillings, its present rate.

In the early coinages the silver penny or sterling was minted with a deep cross. When it was broken into two parts, each was called a *halfpenny*, and when into four, each part was called a *fourth-thing*, or farthing. Larger silver pieces of fourpence were also coined, which were called *greats*, or *groats*, and also *grosses*. There were besides, silver halfpence and farthings minted; but no shillings until the reign of Henry VII. (1504), nor copper coins until the reign of Charles II. (1665.)

As to gold coins, the first after the Norman Conquest, according to Snelling, was struck by order of Henry III. in the year 1257. It weighed two silver pence, passed for twenty pence, and was called the *gold pennie*. The same

author observes, "that the king tried this expedient of coining gold through necessity, and that the city of London made a representation against this measure."

The next gold coinage in England was in the year 1344, when the florin was struck, which took its name from *Florence*, where it had been first minted in 1252. It was afterwards coined in most countries of Europe. In Germany and Holland it was called the *gulden*, on account of its having been originally gold. The florin, however, has been long a silver coin, and also a money of account.

The above coins are supposed to have been of pure gold; but those minted in the subsequent reigns down to that of Henry VIII. were 23 carats $3\frac{1}{2}$ grains fine, with $\frac{1}{2}$ grain of alloy. This was called the old standard to distinguish it from the new or the present standard, which was first called *crown gold*, as being minted into crown pieces in 1527.

The principal gold coins of the old standard were nobles of 6*s.* 8*d.* each, with halves and quarters: the latter were called *farthing nobles*. There were also marks of 13*s.* 4*d.*, angels of 10 shillings, and sovereigns of 20 shillings each. Sovereigns were first minted by Henry VII., and were frequently altered during the four subsequent reigns; but in the 2nd of James I. they were fixed at 22 carats, at which fineness all gold coins have since been minted. The 20 shilling pieces first coined at this rate were called *unites*, and $33\frac{1}{2}$ pieces were struck from the pound troy; but in the reign of Charles II. (1666) a new coinage of $44\frac{1}{2}$ to the lb. was minted, and these were called *guineas*, on account of the country from which the gold was originally brought. The guinea varied in its current price from 20 shillings up to 30, until the year 1717, when, by the recommendation of Sir Isaac Newton, it was fixed at 21 shillings, its present rate.

The system of both metals being standard measures of value, which they were in virtue of each being a legal tender

to any amount, was the source of much disorder; for as their market prices were always subject to variation, one kind of coin had a constant tendency to drive the other out of circulation.

To remedy this great inconvenience, our present monetary system was established in 1816, at which time, as gold was the metal in which the principal payments were made in England, the following law was enacted:—"That gold coins shall be in future the sole standard measure of value, and legal tender of payment, without any limitation of amount, and that silver coins shall be a legal tender for the limited amount of forty shillings only, at any one time."

In the same year a new coinage of 20 shilling pieces, called *sovereigns*, was minted, in due proportion to the guinea, viz. $46\frac{2}{40}$ sovereigns to the pound troy; and an extensive silver coinage also took place, at the new rate of 66 instead of 62 shillings to the troy pound, which affords a profit or *seignorage* of $6\frac{14}{21}$ per cent., but its actual amount must always depend on the market price of the metal.

The total existing quantity of gold when compared with that of silver is estimated to be nearly as 1 to 50, and the relative value of gold to silver is as about 16 to 1; consequently the value of the general silver currency of the world as compared with the gold currency is about 3 to 1. In Great Britain however, gold being the only legal tender for sums above forty shillings, the metallic currency is essentially gold, and the silver and copper coins are only introduced as auxiliary tokens for the purpose of effecting the fractional and smaller payments. The circulation of silver coin, about 13,000,000*l.* sterling including our colonies, is therefore of inconsiderable amount when compared with that of other countries.

The following table, extracted from Kelly's Universal Cambist, exhibits the history of English coins in a condensed form. It should be observed that the last column is calculated according to the Mint proportions which overrate the metallic value of silver.

Table showing the Alterations English Coins have undergone with respect to Weight and Fineness, and also the Comparative Value of Gold and Silver, from the Reign of WILLIAM THE CONQUEROR *to that of* GEORGE IV.

Date.	Reign.	SILVER.			GOLD.			Comparative Value of fine Gold and Silver.	
		Fineness of Silver Coins.		Pound Troy of such Silver coined into	Fineness of Gold Coins.		Pound Troy of such Gold coined into		
		oz.	dwt.	£ s. d.	car.	gr.	£ s. d.	Gold.	Silver.
1066	William I.	11	2	1 1 4	...	...	... ...	...	...
1280	8 Edward I.	—	—	1 1 4	...	...	... ...	...	...
1344	18 Edward III.	—	—	1 1 6	23	3½	14 0 10	1 to 12·584	
1349	23 ———	—	—	1 3 0	—	—	14 18 8	1 — 11·571	
1356	30 ———	—	—	1 6 8	—	—	16 0 0	1 — 11·158	
1421	9 Henry V.	—	—	1 12 0	—	—	17 16 0	1 — 10·331	
1464	4 Edward IV.	—	—	2 0 0	—	—	22 4 6	1 — 10·331	
1465	5 ———	—	—	2 0 0	—	—	24 0 0	1 — 11·158	
1470	49 Henry VI.	—	—	2 0 0	—	—	24 0 0	1 — 11·158	
1482	22 Edward IV.	—	—	2 0 0	...	...	24 0 0	1 — 11·158	
1509	1 Henry VIII.	—	—	2 0 0	...	...	24 0 0	1 — 11·158	
1527	18 ———	—	—	2 2 8	22	0	24 0 0	1 — 11·268	
1543	34 ———	10	0	2 8 0	23	0	28 16 0	1 — 10 434	
1545	36 ———	6	0	2 8 0	22	0	30 0 0	1 — 6·818	
1546	37 ———	4	0	2 8 0	20	0	30 0 0	1 — 5·000	
1547	1 Edward VI.	4	0	2 8 0	20	0	30 0 0	1 — 5 000	
1549	3 ———	6	0	3 12 0	22	0	34 0 0	1 — 5·151	
1551	5 ———	5	0	3 12 0	23	3½	34 0 0	1 — 11·000	
1552	6 ———	11	1	3 0 0	22	0	36 0 0	1 — 11·050	
1553	1 Mary.	11	0	3 0 0	23	3½	36 0 0	1 — 11·057	
1560	2 Elizabeth.	11	2	3 0 0	22	0	36 0 0	1 — 11·100	
1600	43 ———	—	—	3 2 0	23	3½	36 10 0	1 — 10·904	
1604	2 James I.	—	—	3 2 0	22	0	33 10 0	1 — 12·109	
1626	2 Charles I.	—	—	3 2 0	—	—	41 0 0	1 — 13 346	
1666	18 Charles II.	—	—	3 2 0	—	—	44 10 0	1 — 14·485	
1717	3 George I.	—	—	3 2 0	—	—	46 14 6	1 — 15 209	
1816	56 George III.	—	—	3 6 0	—	—	46 14 6	1 — 14·287	
1821	2 George IV.	—	—	3 6 0	—	—	46 14 6	1 — 14·287	

By the above table it appears that silver coins have been diminished in value, during the last 500 years, in the ratio of 99 to 32, and gold coins nearly as $3\frac{1}{2}$ to 1.

In all regular governments, there has been a standard for coins fixed by law; that is, a certain proportion between the quantity of pure metal and its alloy. Thus, the established legal standard for gold in England is $\frac{22}{24}$ or $\frac{11}{12}$; that is, eleven parts of pure metal, and one of alloy. The fineness of gold is generally expressed in carats; the whole weight being supposed to be divided into 24 equal parts or

carats, 22 of which are of pure metal and 2 of alloy: and hence, the English standard gold is said to be 22 carats fine; and the carat is divided into 4 parts, called grains: but these proportions differ in other countries. Experiments have shown that the proportions of the British gold standard give the combination of the two metals[1] which possesses the greatest degree of hardness.

The carat is the 24th part of the pound troy, or 10 pennyweights; and therefore the carat grain is $2\frac{1}{2}$ pennyweights or 60 grains.

The English standard for silver is $\frac{222}{240}$ or $\frac{37}{40}$; it is ex-

[1] Wrought gold has two legal standards; one is 22 carats, the same as the coin, and the other is 18 carats. The latter commenced in 1798, and is used chiefly in the manufacture of watch-cases and rings.

Wrought silver has also two legal standards; one the same as the coin, and the other 8 dwts. better, that is 11 oz. 10 dwts. The latter, called new-sterling, is seldom used.

All articles manufactured of gold and silver, except watch-cases, have to be taken to the Assay Office of the district, and if found of legal quality are stamped thus:—

The Hall Mark, showing the district where manufactured, or the hall where assayed, is at *Birmingham*, an anchor; *Chester*, three wheatsheaves, or a dagger; *Dublin*, a harp or figure of Hibernia; *Edinburgh*, a thistle, or castle and lion; *Exeter*, a castle with two wings; *Glasgow*, a tree, and a salmon with a ring in its mouth; LONDON, a leopard's head; *Newcastle-on-Tyne*, three castles; *Sheffield*, a crown; *York*, five lions and a cross.

The Standard Mark for gold of 22 carats, and silver of 11 oz. 2 dwts., is for England a lion passant; for Edinburgh, a thistle; for Glasgow, a lion rampant; for Ireland, a harp crowned. Gold of 18 carats fine, a crown and the figures 18. Silver of the new standard, figure of Britannia.

The Duty Mark is the head of the Sovereign, and indicates the duty has been paid.

The Date Mark is a letter of the alphabet, which is changed every year; it differs however in different companies. The Goldsmiths' company of London have used the following: from 1716 to 1755, Roman capital letters; 1756 to 1775, small Roman letters; 1776 to 1795, old English letters; 1796 to 1815, Roman capital letters, A to U; 1816 to 1835, small Roman letters a to u; 1836 to 1855, old English letters a to b. In 1856 a new Date Mark will be issued. (I and J are always regarded as one letter)

pressed in troy ounces and pennyweights, that is, 11 oz. 2 dwt. of pure, and 18 dwt. of alloy, making together 1 pound troy.

The alloy of silver is mostly copper, and that of gold both silver and copper; but in the computation of coins the alloy is never reckoned of any value, being always allowed in order to save the trouble and expense that would be incurred in refining the metals to their highest degree of purity.

Besides this standard fineness of coins, there is also a legal weight fixed according to the mint regulation or rate of coinage of each country. Thus, in England a pound troy of standard gold is coined into $44\frac{1}{2}$ guineas, or $46\frac{2}{40}$ sovereigns, and a pound of standard silver into 66 shillings, with divisions and multiples in proportion; and hence, the mint price of standard gold is 3*l.* 17*s.* $10\frac{1}{2}$*d.* per ounce, and that of standard silver, 66 pence per ounce. Before the year 1816, silver was coined at the rate of 62 pence per ounce; and this is sometimes reckoned the standard price in the valuation of foreign silver coins.

Copper money is coined in the proportion of 24 pence to the pound avoirdupois. Thus the penny should weigh $10\frac{2}{3}$ drams or $291\frac{2}{3}$ grains, and the other pieces in proportion.

Silver coin is a legal tender for the limited amount of 40 shillings; and copper to the amount of 12 pence.

According to the mint regulations of most countries, there is an allowance for deviation from the standard weight and fineness of coins, which is called the *remedy of the mint.* In some places the remedy is allowed in the weight, in others in the fineness; but mostly in both weight and fineness. It is considered generally as an allowance for the fallibility of workmanship. In some mints, however, it is made a source of emolument; and where governments issue coins at a rate above their intrinsic value, or the market price of the metal, the profit thus made is called *seignorage*, and charges for mint expenses are called *brassage.*

The *remedy of the mint*, according to the law of 1815, for gold coins is 12 grains per lb. in the weight, and $\frac{1}{16}$ of a

carat in the fineness ; and for silver coins 1 dwt. per lb. in the weight, and the same in the fineness. The remedy for copper coins is $\frac{1}{40}$ of the weight.

The following tables exhibit the British imperial standard weights and fineness of the various coins ; those marked † are not now in ordinary circulation :—

British Gold Coins.

Number of pieces in the Troy pound.	Standard Weight of each piece.	Fine Gold in each piece.	Alloy in each piece.
	gr.	gr.	gr.
$93\frac{9}{20}$ Half sovereigns	61·637	56·500	5·137
$46\frac{7}{40}$ Sovereigns	123·274	113·001	10·273
†$92\frac{2}{20}$ £2 pieces	246·548	226·003	20·545
† $9\frac{69}{200}$ £5 „	616·372	565·008	51·364
†178 $\frac{1}{4}$ guineas	32·3595	29·6629	2·6966
†$133\frac{1}{2}$ $\frac{1}{3}$ „	43·1460	39·5505	3·5955
† 89 $\frac{1}{2}$ „	64·7190	59·3258	5·3932
† 44 Guineas	129·4382	118·6516	10·7866
† $22\frac{1}{4}$ 2 guineas	258·8764	237·3034	21·5730
† $8\frac{1}{2}$ 5 guineas	647·1910	593·2584	53·9326

Gold Standard { 22 carats, or $\frac{11}{12}$ fine gold ; 2 „ $\frac{1}{12}$ alloy } per pound troy.

British Silver Coins.

Number of pieces in the Troy pound.	Standard Weight of each piece.	Fine Silver in each piece.	Alloy in each piece.
	gr.	gr.	gr.
†792 Pence	7·2727	6·7273	0·5455
†396 Twopences	14·5455	13·4545	1·0909
264 Threepences	21·8182	20·1818	1·6364
198 Fourpences	29·0909	26·9091	2·1818
132 Sixpences	43·6364	40·3636	3·2727
66 Shillings	87·2727	80·7273	6·5455
33 Florins	174·5455	161·4545	13·0909
$26\frac{2}{5}$ Halfcrowns	218·1818	201·8182	16·3636
$13\frac{1}{5}$ Crowns	436·3636	403·6364	32·7273

Silver Standard { 11 oz. 2 dwt. or $\frac{37}{40}$ fine silver ; 18 „ $\frac{3}{40}$ alloy } per pound troy.

British Bronze Coins.

An avoirdupois pound of copper was formerly coined into twenty-four pence, or forty-eight halfpence, or ninety-six farthings. In 1860 these were replaced by a bronze coinage, of less weight, composed of ninety-five parts of copper, four

of tin, and one of zinc. A pound of bronze (7,000 grains) is coined into forty-eight pence, or eighty halfpence, or one hundred and sixty farthings.

The halfpence measure exactly an inch in diameter, so that, in case of emergency, twelve of them placed in a line might be used as a substitute for a foot-rule.

These bronze coins are also available as convenient letter-weights, observing that

3 pence
5 halfpence
or 10 farthings
} go to the ounce.

The silver coins in circulation are considered only as tokens, payable by the government, and pass for more than their metallic value as compared with gold. Precaution is taken that it shall not be worth while to melt the silver coin into bullion, and it is so nearly worth its current value that imitation would not be ventured on so small a profit. The government will always receive back its tokens however worn they may be, provided they be not wilfully defaced or fraudulently reduced. But gold, being the sole standard measure of value, and legal tender of payment, circulates as a commodity; and hence the necessity of government receiving it at value on its return to the mint, and making a deduction for loss of weight when the same exceeds the remedy of the mint. The wear and tear of the gold coinage is such, that very nearly 3 per cent. of the whole circulation goes out annually; and the quantity which will suffice to throw a sovereign out of circulation is about one-fourth of a grain.

In 1853 a Select Committee was appointed to take into consideration, and report to Parliament, the practicability and advantages, or otherwise, that would arise from adopting a decimal system of coinage. The practical substance of the Report is conveyed in the following extracts.

"The first question to be decided is, what shall be the unit of the new system of coinage; and your Committee have no hesitation in recommending the present pound sterling. Considering that the pound is the present standard,

and therefore associated with all our ideas of money value, and that it is the basis on which all our exchange transactions with the whole world rest, it appears to your Committee that any alteration of it would lead to infinite complication and embarrassment in our commercial dealings; in addition to which it fortunately happens, that its retention would afford the means of introducing the decimal system with the minimum of change. Its tenth part already exists in the shape of the florin or two-shilling piece, while an alteration of four per cent. in the present farthing will serve to convert that coin into the lowest step of the decimal scale which it is necessary to represent by means of an actual coin, viz. the thousandth part of a pound. To this lowest denomination your Committee propose, in order to mark its relation to the unit of value, to give the name of mil. The addition of a coin to be called a cent., of the value of 10 mils, and equal to the hundredth part of the pound, or the tenth part of the florin, would serve to complete the list of coins necessary to represent the monies of account, which would accordingly be pounds, florins, cents, and mils.

"As respects the coins, it will be necessary to withdraw from circulation certain of the coins at present in use, and to substitute in their place other coins, having reference to the decimal scale, before the decimal system can be considered as fully developed. Your Committee contemplate the retention under any circumstances, of the present sovereign (1000 mils), half-sovereign (500 mils), florin (100 mils), and shilling (50 mils, or 5 cents). The present sixpence, under the denomination of 25 mils, might be retained, and the crown, or piece of 250 mils, of which few are in circulation, need not be withdrawn. On the other hand, it will be desirable to withdraw the halfcrown, and the threepenny and fourpenny pieces, which are inconsistent with the decimal scale.

"With regard to the coins not in actual existence, but which it will be necessary eventually to introduce, it appears to your Committee, from the evidence taken by them on the

subject, that copper coins of 1, 2, and 5 mils, and silver coins of 20 and 10 mils, will be required, to which should be added such others as experience may show to be desirable. It is important, however, to bear in mind, that the smaller the number of the coins with which it is practicable to effect purchases and exchanges, the better.

"Your Committee recommend that all the silver coins hereafter coined should have their value in mils marked upon them, in order that the public might, at the earliest possible period, associate the idea of the system with their different pecuniary transactions. They further recommend that all the copper coins that may be issued under the decimal system, should also have their value in mils similarly marked upon them. They believe that the necessary inconvenience attending a transition state will be far more than compensated by the great and permanent benefits which the change will confer upon the Public of this country, and of which the advantages will be participated in to a still greater extent by future generations."

Such is the decimal system of coinage recommended by the Committee, after having taken voluminous evidence upon the subject, and we must here accord to the report our full and unreserved approval, not only as regards the general principle, but in all its details. It must eventually be adopted, and it is indeed convenient that so little modification in existing coins will be requisite to bring it into practical operation. The radical coins in circulation will be pounds, florins, cents, and mils; but it will not be absolutely essential to treat them as separate moneys of account. There will be no necessity to employ any other denominations in accounts than the pound and mil—that is, the pound and its decimals. For further details on this subject we must refer to Dr. Bowring's treatise on "The Decimal System," which also contains well-executed wood-cut illustrations of English, French, Greek, and Roman coins, and an elaborate and interesting chapter on the numerals of different nations.

COMPUTATION OF COINS AND BULLION.

The value of bullion, or of a gold or silver coin, depends entirely upon the quantity of pure metal which, by a process called its assay, it is found to contain. The alloy which enters into its composition, is not estimated in the value, being always disregarded, and allowed as a compensation for the expense of refining.

Assays of gold are weighed in carats and carat grains, the carat being a nominal weight containing 4 carat grains. The carat weight is usually considered to be the 24th part of the pound troy = 10 dwts. = 240 grains troy; according to which the carat grain = 60 grains troy. It is not, however, requisite to give to it any fixed or absolute weight, as it is only used to determine the proportions of pure metal and alloy.

Assays of silver are weighed in ounces and pennyweights, the ounce being a nominal weight containing 20 pennyweights, and so far these weights are analogous to the troy table.

The British standard of gold is 22 carats fine; that is to say, 24 carats weight of the metal should contain just 22 carats of fine or pure gold, the same being $\frac{11}{12}$ of the total weight[1].

The British standard of silver is 11 oz. 2 dwts. fine; that is, 12 oz. weight of the metal should contain just 11 oz. 2 dwts. of fine or pure silver, being $\frac{222}{240}$ or $\frac{37}{40}$ of the total weight[1].

The reports of English assayers are made after comparing the ascertained weights with these standards, the difference being usually called the betterness or worseness of the metal, as the case may be. Thus gold found to be 23 carats 2 grains fine, is reported "better 1 carat 2 grains;" and gold of 20 carats 2 grains is reported "worse 1 carat 2 grains." Also pure silver, 12 oz. fine, would be reported

[1] The British standards are also the mintage standards of the gold and silver coins of the realm.

"better 18 dwts.;" and silver ascertained to be 9 oz. 14 dwts. fine would be reported "worse 1 oz. 8 dwts."

Gold. Let w denote the total weight of a piece of gold or gold coin, expressed in troy grains; and g the number of carat grains in the fineness of the metal, as obtained from the assay report.

Then, as the British standard of fineness contains 88 carat grains, the proportion of standard gold contained in the metal is expressed by the fraction $\frac{g}{88}$. Consequently the actual weight, in troy grains, of standard gold contained in the piece $= \frac{wg}{88}$.

The same, in troy ounces, $= \frac{wg}{88} \times \frac{1}{480} = \frac{wg}{42240}$.

Now, the Mint value of a troy ounce of standard gold is 3*l.* 17*s.* $10\frac{1}{2}d.$, which, expressed in fractions of the pound sterling, $= \frac{623}{160}$.

Therefore the value of the piece of gold or coin, expressed in pounds sterling $=$

$$\frac{wg}{88} \times \frac{1}{480} \times \frac{623}{160} = \frac{6{\cdot}23}{67584} wg = \frac{wg}{10848}.$$

The same, in shillings sterling, $= \frac{10wg}{5424} = \frac{{\cdot}059}{32} wg$.

From the preceding the following practical rules are deduced:

(1.) From an assay report on gold metal to find the *fineness.*

Rule. Put down 22 carats and the report underneath it: add the report if "better," or subtract it if "worse," and the sum or difference will be the "carats fine."

(2.) From an assay report and the weight of a piece of gold, or gold coin, to find the quantity of *fine* or *pure* gold it contains.

Rule. Find the fineness by (1), and reduce the same to

carat grains at the rate of 4 grains to the carat. Multiply the full weight of the metal by this number of carat grains, and divide by 96. The result will be the "fine weight."

(3.) To find the quantity of *standard* gold contained in the piece.

Rule. Proceed as in (2); only divide by 88 instead of 96, and the result will be the "standard weight."

Otherwise, multiply the weight of the piece by the number of carat grains in the assay report, "better or worse;" divide by 88, and add the quotient to the full weight, if "better," or subtract it if "worse."

(4.) To find the *value* of a piece of gold, or gold coin, in sterling money.

Rule. From the assay report determine the fineness by (1); reduce it at the rate of 4 grains to the carat, and multiply the number so found into the total weight of the metal, or coin, expressed in troy grains. Then divide the product by 10848, and the result will be the required value expressed in pounds sterling; or, otherwise, multiply the product by 59, divide by 4 and by 8, and finally cut off three decimals, and the result will be the required value expressed in shillings sterling.

The value, in shillings sterling, of a piece of gold, or gold coin, may be otherwise obtained from the calculated number of grains of fine gold it contains, by multiplying the same by ·177.

Silver. Let w be the weight of a piece of silver, or silver coin, expressed in troy grains; p the number of pennyweights contained in its degree of fineness.

Then, as the British standard of fineness contains 222 dwts., the proportion of standard silver is $\frac{p}{222}$, and the actual quantity of standard silver, in troy grains, $= \frac{wp}{222}$.

The same in troy ounces $= \frac{wp}{222} \times \frac{1}{480} = \frac{wp}{106560}$.

Thus, taking[1] 5*s.* or 60*d.* as the value of a troy ounce of standard silver, the value of the piece of silver or coin, expressed in pence sterling =

$$\frac{wp}{222} \times \frac{1}{480} \times 60 = \frac{wp}{1776}.$$

Hence the following practical rules for computations of silver:—

(1.) From an assay report on silver metal to find the *fineness.*

Rule. Put down 11 oz. 2 dwts., and the report underneath it; add the report if "better," or subtract it if "worse," and the sum or difference will be the "fineness."

(2.) From an assay report and the weight of a piece of silver, or silver coin, to find the quantity of *fine* or *pure* silver it contains.

Rule. Find the fineness by (1), and reduce the same to dwts., at the rate of 20 dwts. to the ounce. Multiply the full weight of the metal by this number of dwts., and divide by 240, and the quotient will be the "fine weight" required.

(3.) To find the quantity of *standard* silver.

Rule. Proceed as in (2); only divide by 222 instead of 240, and the result will be the "standard weight."

Otherwise, multiply the weight of the piece by the number of dwts. in the assay report, "better" or "worse:" divide by 222, and add the quotient to the full weight, if "better," or subtract it if "worse."

(4.) To find the *value* of a piece of silver, or silver coin.

Rule. From the assay report ascertain the fineness by (1); reduce it to dwts., at the rate of 20 dwts. to the ounce, and multiply the number so found into the total weight of the metal, or coin, expressed in troy grains. Divide the product by 1776 (or, if preferred, by 4, 4, and 111), and

[1] The Mint price of standard silver, which was formerly 62*d.*, is now 66*d.* per ounce; but this is above the average market value, which is considered to be about 60*d.*, the price now usually adopted in the valuation of coins.

the result will be the required value expressed in pence sterling.

The value in pence sterling may be also obtained from the calculated number of grains of pure silver, by multiplying the same by 10, and then dividing by 74; or it may be obtained from the number of grains of standard weight, by simply dividing by 8.

Note.—In France and Holland assays are made on the decimal system, the *proportion* of fine metal estimated in thousandth parts of the whole weight being called MILLIÈMES. By some assay calculators the same proportion put down in hundredth parts, which, of course, expresses the pure metal as a per centage, is called the TOUCH.

Both the Bank and the Mint now receive decimal reports, which are both simple and convenient, and will ultimately supersede the unnecessary cumbrous system of carats and carat grains.

To calculate the fine weight from a decimal report it is only requisite to multiply the total weight by the millièmes and then to point off three decimals.

To obtain the value of coin from the fine weight:—

$$\left.\begin{matrix}\text{Silver}\\ \text{Gold}\\ \text{,,}\end{matrix}\right\}\ \text{fine grains} \times \left\{\begin{matrix}\frac{10}{74}\\ 2\frac{1}{8}\\ 0{\cdot}177\end{matrix}\right\} = \text{value in} \left\{\begin{matrix}\text{pence}\\ \text{,,}\\ \text{shillings}\end{matrix}\right\} \text{sterling.}$$

For bullion:—

$$\left.\begin{matrix}\text{Silver}\\ \text{Gold}\end{matrix}\right\}\ \text{fine ounces} \times \left\{\begin{matrix}\frac{10}{37}\\ 4\frac{1}{4}\end{matrix}\right\} = \text{value in pounds sterling.}$$

With the gold, if worth while, deduct 1*d.* for every 8*l.* of value from this last calculation.

To show by actual examples the practical application of the foregoing rules, the several calculations have been made with respect to various coins, and the results of these calculations are exhibited in the last four columns of the following table. These results are determined from the data given in the two preceding columns, viz. the Assay and the Weight.

ASSAYS, WEIGHTS, AND VALUES OF GOLD AND SILVER COINS.

Coin.	Assay.	Weight.	Fineness.	Fine weight, or pure metal.	Standard weight.	Value in sterling.
GOLD.	car. gr.	grains.	car. gr.	grains.	grains.	s. d.
Austria..... Ducat.....	B 1 $2\frac{3}{4}$	54	23 $2\frac{3}{4}$	53·30	58·14	9 5·2
Baden ..... Ducat.....	B 1 $2\frac{3}{4}$	$47\frac{1}{2}$	23 $2\frac{3}{4}$	46·90	51·17	8 3·6
England ..... Sovereign	Standard	$123\frac{1}{4}$	22 0	112·98	123·25	20 0
France..... Napoleon, or 20 franc piece.....	W 0 $1\frac{3}{4}$	$99\frac{1}{2}$	21 $2\frac{1}{4}$	89·40	97·52	15 9·9
Hanover ..... Ducat	B 1 $3\frac{1}{2}$	$53\frac{5}{6}$	23 $3\frac{1}{2}$	53·33	58·18	9 5·3
,, Gold Florin	W 3 $0\frac{1}{2}$	50	18 $3\frac{1}{2}$	39·32	42·90	6 11·5
Holland..... Ducat.....	B 1 $2\frac{1}{4}$	$53\frac{3}{4}$	23 $2\frac{1}{4}$	52·77	57·57	9 4·1
Milan ..... Sequin	B 1 3	$53\frac{3}{4}$	23 3	53·19	58·03	9 5·0
Naples ..... Oncetta, or 3 ducat piece (1818)	B 1 $3\frac{1}{2}$	$58\frac{1}{4}$	23 $3\frac{1}{2}$	57·95	63·21	10 3·1
Prussia..... Frederick (1800)....	W 0 2	103	21 2	92·27	100·66	16 4·0
Russia ..... Ducat (1796).....	B 1 $2\frac{3}{4}$	54	23 $2\frac{3}{4}$	53·16	57·99	9 4·9
,, Imperial (1801).....	B 1 $2\frac{1}{4}$	$185\frac{1}{2}$	23 $2\frac{1}{4}$	181·87	198·41	32 2·3
Spain ..... Doubloon (1772)....	W 0 $2\frac{1}{4}$	$416\frac{1}{2}$	21 $1\frac{3}{4}$	372·03	405·85	65 10·2
,, Pistole (1801).....	W 1 1	$104\frac{1}{4}$	20 3	90·13	98·33	15 11·4
Sweden ..... Ducat	B 1 2	53	23 2	51·90	56·61	9 2·2
United States, Eagle	W 0 $0\frac{1}{2}$	270	21 $3\frac{1}{2}$	246·09	268·47	43 6·7
SILVER.	oz. dwt.	dwt. gr.	oz. dwt.	grains.	grains.	s. d.
Austria..... Rixdollar (1800) ...	W 1 5	18 1	9 17	355·4	384·2	4 0
,, Copfstuck, or 20 kreutzer piece ...	W 4 3	4 $6\frac{1}{2}$	6 19	59·4	64 2	0 8
East Indies... Sicca Rupee, coined at Calcutta by the East India Company	B 0 13	7 $11\frac{1}{2}$	11 15	175·8	190·0	1 11·8
,, Rupee of later coinage	B 0 $4\frac{1}{2}$	7 $8\frac{1}{2}$	11 $6\frac{1}{2}$	166·6	180·1	1 10·5
,, Company's Rupee now in circulation	W 0 2	7 12	11 0	165·0	178·4	1 10·3
England ..... Shilling, or half-florin	Standard	3 21	11 2	86·0	93 0	0 11·6
France ..... Franc (1818).....	W 0 7	3 $5\frac{1}{2}$	10 15	69·4	75 1	0 9·4
Hamburgh ... Rixdollar specie ...	W 0 10	18 18	10 12	397·5	429·7	4 5·7
Holland ..... Florin, or Guilder.	W 0 $4\frac{1}{2}$	6 18	10 $17\frac{1}{2}$	146·3	158·7	1 7·8
Milan ..... Lira.....	W 4 10	4 0	6 12	52·8	57·1	0 7·1
Naples ..... Ducat.....	W 1 0	14 15	10 2	295·4	319·4	3 3·9
Netherlands.. Florin (1816).....	W 0 $7\frac{1}{2}$	6 22	10 $14\frac{1}{2}$	148·4	160·4	1 8
Portugal ..... New Crusado (1809)	W 0 4	9 3	10 18	198·9	215·1	2 2·9
Prussia..... Rixdollar (Convention)	W 1 3	18 1	9 19	359·0	388·1	4 0·5
Russia ..... Ruble (1805).....	W 0 16	13 12	10 6	278·1	300·6	3 1 6
,, 10 Copec piece (1802)	W 0 13	1 $8\frac{1}{2}$	10 9	28·3	30·6	0 3·8
Sardinia (Piedmont), 5 Franc piece (1801)	W 0 8	16 $1\frac{1}{2}$	10 14	343·7	371·6	3 10·5
Sicily..... Scudo	W 1 4	17 14	9 18	348·1	376·4	3 11·0
Spain..... Dollar.....	W 0 8	17 8	10 14	370·9	401·0	4 2·1
Sweden..... Rixdollar	W 0 $14\frac{1}{3}$	18 17	10 $7\frac{2}{3}$	388·5	420·0	4 4·5
Tuscany ..... Lira (1803).....	B 0 7	2 8	11 9	53·4	57·8	0 7·2
United States, Dollar.....	W 0 $8\frac{1}{2}$	17 8	10 $13\frac{1}{2}$	370·1	400·1	4 2·0
Venice ..... Ducato	W 1 5	14 6	9 17	280·7	303·5	3 1·9

GENERAL PRINCIPLES OF EXCHANGE.

A Bill of Exchange is a written order addressed by one person to another, directing the latter to pay on account of the former to some third person, or his order, or to the order of the person drawing the bill, a certain sum of money at a time therein specified. It is a mercantile contract, in which four persons are mostly concerned, viz.:—

The *drawer* and *seller* of the bill, who receives the value.

The *drawee*, his debtor, upon whom the bill is drawn. He is called the *acceptor*, when he writes his acceptance across the bill, and thereby engages to pay it when it becomes due.

The *payee*, or person to whom it is ordered to be paid, and who may, by indorsement, pass it to any other person.

The *buyer*, who gives value for the bill. Mercantile payments are, for the most part, made in bills of exchange, which generally pass from hand to hand, like any other circulating medium, until due. The person who at any time has a bill in his possession is called the *holder*, the payee being the holder in the first instance. When the holder of a bill disposes of it, he writes his name on the back, which is called *indorsing*. Any person may indorse a bill, and every indorser, as well as the acceptor or payee, is a security for the bill, and liable to be sued for payment.

Some bills are drawn at sight; others at a certain number of days, or months, after date, or after sight, and some at *usance*, which is meant to express the customary or usual term between different places. Days of grace are a certain number of days granted to the acceptor or payee, after the term of the bill is expired.

Inland exchange is the remittance of bills to places in the same country, by which means debts are discharged more conveniently than by cash remittances. Thus reciprocal debts, of equal amount, due between persons in different

parts of the country, may be discharged without remitting specie, and such an operation is recommended by general convenience; but when the debts are unequal, the debtor place must pay its balance, either by transmitting cash or bills; and as the latter mode is generally preferred, an increased demand for bills must be the consequence, which enhances their price, as it would that of any other article of sale or purchase.

This is the principle of exchange, and it is exemplified in the premium paid for inland bills on London. The metropolis is the grand emporium of commerce that supplies other places in the kingdom with foreign merchandise, and being also the seat of government to which the revenue is transmitted, and the residence of wealthy landlords, whose rents must be remitted to them from the country, it has generally a large balance of debt in its favour; and as this balance is chiefly paid in bills, a demand for them is created, and a premium is the consequence. The premium on inland bills is generally commuted for time; that is, for a certain number of days after date, or after sight, which date, or term, varies according to the demand and other circumstances.

Foreign exchange is essentially the same as that of inland, with respect to settling accounts by a transfer of claims, and also by the premium or price of bills being regulated by the proportion between the demand and the supply; but the mode of paying the premium for foreign bills is different, and the operation of adjustment is more complicated, owing to the introduction of the comparative values of different moneys, since different countries have different coins, different in denomination, in weight, and consequently in value.

In foreign exchange, one place always gives another a fixed sum, or piece, of money for a variable price, expressed by other coins; the former is called the *certain price*, and the latter the *uncertain price*. Thus London is said to

give to Paris the certain for the uncertain when the pound sterling is made exchangeable for a variable number of francs; and to Spain the uncertain for the certain when a variable number of pence sterling is exchangeable for the dollar of exchange. The uncertain price, as quoted at any time, is called the *rate*, or *course of exchange*.

When the demand in London for bills on Paris is great, a less number of francs is given for the pound sterling, and *vice versâ*. Again, if the course of exchange between London and Paris be 25 francs for the pound sterling, and if this number of francs contains the same quantity of pure silver as 20 shillings sterling, then the exchange is considered at par; but if Paris should give a higher price, the exchange is said to be against France, and in favour of England. This is the general mode of judging whether the exchange is favourable or unfavourable, though it is not always that on which merchants act or speculate.

The *intrinsic par* of exchange is the value of the money of one country compared with that of another, with respect both to weight and fineness according to accredited assays. It is, in effect, the metallic par; for though the moneys of exchange are many of them imaginary, their value is always deducible from that of the coins they represent, or to which they have an established relation.

The *commercial par* is the comparative value of the moneys of different countries, according to the weight, fineness, and market prices of the metals.

Thus two sums of different countries are *intrinsically* at par when they *contain* an equal quantity of the same kind of pure metal; and two sums of different countries are *commercially* at par when they can *purchase* an equal quantity of the same kind of pure metal.

The intrinsic par of exchange may be computed from gold or from silver coins. As a general rule, the measure of value should be of that metal in which the principal payments are made; and, therefore, in some countries the par

should be computed from gold, and in others from silver, according to the kind of money in which bills of exchange are paid. It is, however, obvious that the intrinsic par of exchange can be determined only between places which pay their bills in the same kind of metal. Even the same metal must differ considerably between two countries where one possesses mines, and supplies the other with materials of coinage, as between Spain and France, or between Portugal and England. The difference in all such cases is usually estimated according to the expenses of transporting the precious metals; and thus, from the intrinsic par and the various charges and prices, the commercial equivalence is computed.

The fluctuations of exchange are occasioned by various circumstances, both political and commercial. A greater or less demand for money in a stated place at a particular time may increase or diminish its commercial value without reference to its intrinsic value. The principal cause of fluctuation is generally stated to be the *balance of trade*, by which is meant the difference between the commercial exports and imports of one country with respect to another. The demand for bills of exchange arises out of the necessity of paying for importations. The supply arises out of the practice of drawing for the amount of exportations. If the supply and the demand be equal, if for every pound's worth of goods imported there be a pound's worth of exported goods to be drawn for, there will be no real exchange; that is, the real exchange, however much the nominal exchange may alter, will be at par. When, however, the importations are not equal to the exportations, exchange can no longer remain at par. An excess of importation would cause the exchange to advance against the importing country, and *vice versâ*. The exchange may, however, be unfavourable to a country when the balance of trade is greatly in its favour; for the demand for bills must chiefly depend on the balance of such debts as come into immediate liquidation, that is to say, on the

balance of payments. Besides, it does not follow that large exports are always successful, or quick in their returns; and even should this be the case, the balance of payments may be still unfavourable from political causes, such as foreign loans, subsidies, expeditions, or colonial establishments.

When any legal changes take place in the coinage or currency of a country, the exchange will of course vary, so as to keep pace or correspond with such alterations. The same remark is applicable to the debasement of coin through clipping and wear. This, however, cannot in either case be considered as an absolute change in the price of bills, but only in the money or medium through which they are bought or sold.

In times of peace, the course of exchange seldom remains long unfavourable to a country, at least beyond the expenses that might be incurred by the transportation of the precious metals; for bullion is considered the universal currency of merchants, and exchange gives it circulation, and thus tends to maintain the level of money throughout the commercial world. An unfavourable rate of exchange also operates as an encouragement to the exportation of goods, and as a check against the importation; for the exporter can afford to sell the goods cheaper in proportion to the premium which he receives for his bill, while the discount on bills from abroad operates as a tax or duty on importation. Thus exchange has always, in ordinary times, a natural tendency to restore an equilibrium.

MEASURES, WEIGHTS, AND MONEYS.

For the purpose of easy reference amongst the extensive details contained under this head, the measures and weights of Great Britain, and the tables appertaining to them, are first enumerated and explained, and those of other countries are afterwards given according to the alphabetical order of the several places. The English equivalents are uniformly in relation to Imperial measures, and avoirdupois weights are always to be understood, unless otherwise stated. Troy grains and avoirdupois grains are identical in value, though the English grain has generally the former denomination, being originally derived from the standard troy pound. The names of places given at the top of the pages always refer to the contiguous matter immediately underneath them, this arrangement being considered the clearest for rapid reference.

GREAT BRITAIN.

The act, 5 Geo. IV. c. 74, for establishing uniformity of weights and measures, came into operation on the 1st of January, 1826. The measures of capacity are the only ones which it changed. The old wine gallon contained 231 cubic inches; the corn gallon, 268·8; and the old ale gallon, 282. These were altered to the uniform imperial gallon, containing 277·274 cubic inches. The imperial standards remain unaltered in the Weights and Measures Act, 1878, now in force.

Measures of Length.

3	barleycorns	make	1 inch.
12	inches	„	1 foot (12 inches).
3	feet	„	1 yard (36 inches).
5½	yards	„	1 rod, pole or perch (5½ yards or 16½ feet).
4	poles or 100 links	„	1 chain (22 yards or 66 feet).
10	chains	„	1 furlong (220 yards or 660 feet).
8	furlongs	„	1 mile (1760 yards or 5280 feet).

A line is the $\frac{1}{12}$th part of an inch.
A nail is 2¼ inches (used in measuring cloth).
A palm is 3 inches.
A hand is 4 inches (used for measuring the height of horses).

A span is 9 inches.
A cubit is $1\frac{1}{2}$ foot.
A military pace is $2\frac{1}{2}$ feet.
An itinerary pace is 5 feet.
A Scotch ell is 37·06 inches } (used in measuring holland and other cloth).
An English ell is 45 inches }
A fathom is 2 yards or 6 feet (used in sounding depths).
A cable's length is 120 fathoms or 240 yards.
A league is 3 miles.
A degree of the equator is 69·1613 miles or 365172 feet.
A degree of the meridian is 69·046 miles or 364565 feet.

The old Scotch and Irish miles are $1\frac{1}{8}$ and $1\frac{3}{11}$ English.

Among ordinary mechanics, the inch is usually divided into eighths; but in scientific calculations it is mostly divided into decimals, or otherwise the foot is decimally divided.

Measures of Surface.

144	square inches	make 1 square foot.
9	square feet	,, 1 square yard.
$30\frac{1}{4}$	square yards	,, 1 pole, rod or perch ($30\frac{1}{4}$ square yards).
16	poles	,, 1 chain (484 square yards).
40	poles	,, 1 rood (1210 square yards).
4	roods, or 10 chains	,, 1 acre (4840 square yards).
640	acres	,, 1 square mile.

Measures of Capacity. 1. *Dry Measure.*

4	gills	make 1 pint	(34·659 cubic inches).
2	pints	,, 1 quart	(69·318 cubic inches).
4	quarts	,, 1 gallon	(277·274 cubic inches).
2	gallons	,, 1 peck	(2 gallons).
4	pecks	,, 1 bushel	(8 gallons).
4	bushels	,, 1 coomb	(4 bushels).
2	coombs	,, 1 quarter	(8 bushels).
5	quarters	,, 1 wey or load	(40 bushels).
2	weys	,, 1 last	(80 bushels or 10 quarters)

A pottle is 2 quarts or half a gallon.
A strike is 2 bushels.
A cubic foot is 1728 cubic inches.
A cubic yard is 27 cubic feet; which measure of earth is called a load.

2. *Wine and Spirit Measure.*

4	gills	make	1 pint	(34·659 cubic inches).
2	pints	,,	1 quart	(69·318 cubic inches).
4	quarts	,,	1 gallon	(277·274 cubic inches).
36	gallons	,,	1 tierce	(36 gallons).
1½	tierces	,,	1 hogshead	(54 gallons).
2	hogsheads	,,	1 pipe, butt, or puncheon	(108 gallons).

The larger quantities, such as hogsheads, puncheons, &c. are gauged, and charged according to the actual contents.

3. *Ale, Beer, and Porter Measure.*

4 gills [1]	make	1 pint.	
2 pints	,,	1 quart.	
4 quarts	,,	1 gallon	(277·274 cubic inches).
9 gallons	,,	1 firkin	(9 gallons).
2 firkins	,,	1 kilderkin	(18 gallons).
2 kilderkins	,,	1 barrel	(36 gallons).
3 kilderkins	,,	1 hogshead	(54 gallons).
2 hogsheads	,,	1 butt	(108 gallons).
2 butts	,,	1 tun	(216 gallons).

To reduce cubic inches to bushels.

Rule. Multiply by 5, and divide by 11091.

To reduce cubic inches to gallons.

Rule. Multiply by 40, and divide by 11091.

WEIGHTS.

Troy Weight.

24 grains	make	1 pennyweight	(24 grains).
20 pennyweights	,,	1 ounce	(480 grains).
12 ounces	,,	1 pound	(5760 grains).

By troy weight gold, silver, jewels, and precious stones are weighed. Diamonds and pearls are an exception; they

[1] In London the gill is commonly called a "quartern;" in the North of England the gill is termed a "noggin," and a half-pint is called a "gill."

are weighed by the carat, which contains 4 grains; but 5 diamond grains are only equal to 4 troy grains; the ounce troy containing 150 diamond carats.

The imperial standard pound troy, made in the year 1758, is that from which all other weights are obtained: $\frac{1}{12}$th of it is the troy ounce; $\frac{1}{20}$th of the ounce is a pennyweight; and $\frac{1}{24}$th of the pennyweight is a grain; so that 5760 grains is a troy pound, and 7000 such grains is a pound avoirdupois, the grain in each case being identical.

Apothecaries' Weight.

20 grains	make	1 scruple	(20 grains)	sign ℈.
3 scruples	,,	1 drachm	(60 grains)	sign ʒ.
8 drachms	,,	1 ounce	(480 grains)	sign ℥.
12 ounces	,,	1 pound	(5760 grains)	sign *lb.*

Apothecaries compound their medicines by these weights, but buy and sell by avoirdupois.

The *pound*, *ounce*, and *grain*, are the same as in *troy* weight.

Apothecaries' Fluid Measure.

60 minims (♏)	make	1 drachm	(*f* ʒ).
8 drachms	,,	1 ounce	(*f* ℥).
20 ounces	,,	1 pint.	
8 pints	,,	1 gallon.	

Avoirdupois Weight.

16 drams	make	1 ounce	(437½ grains).
16 ounces	,,	1 pound	(7000 grains).
14 pounds	,,	1 stone	(14 lbs.).
2 stone	,,	1 quarter	(28 lbs.).
4 quarters	,,	1 hundred	(cwt.) (112 lbs.)
20 cwt.	,,	1 **ton**	(2240 lbs.).

The new act, 1878, declares that "all articles sold by weight shall be by avoirdupois weight, except gold, silver, platinum, diamonds, and other precious metals or stones, and drugs when sold by retail; and that such excepted articles, and none others, may be sold by troy weight."

The stone formerly varied from 8 lb. to 16 lb. in different places; but by the act passed in 1834, the stone is to consist of 14 lb. avoirdupois, and the cwt. of 8 stone; and all contracts made by any other measure are null and void.

Hay and Straw.

36 pounds	make	1 truss of Straw.
56 pounds	,,	1 truss of Old Hay.
60 pounds	,,	1 truss of New Hay.
36 trusses	,,	1 load.
18 cwt.	,,	1 load of Old Hay.
19 cwt. 32 lbs.	,,	1 load of New Hay.
11 cwt. 64 lbs.	,,	1 load of Straw.
1 cubic yard of New Hay weighs		6 stone.
1 ———— Oldish Hay	,,	8 stone.
1 ———— Old Hay	,,	9 stone.

Hay is considered as new for three months, and is called old on the 1st of September.

To find the weight of Hay contained in a Stack.—Multiply the length of the stack by its breadth, and multiply the result by its height, all in feet; divide the product by 27, which will give the number of cubic yards; this multiply by 6, 8, or 9, according to the age of the hay, as above, and the product will be the weight in stones. In measuring the height deduct two-thirds of the distance in feet from the eaves to the top.

Coal.

14 pounds	make	1 stone.
28 pounds	,,	1 quarter cwt.
56 pounds	,,	1 half cwt.
1 sack of 112 pounds	,,	1 cwt.
1 double sack of 224 pounds	,,	2 cwt.
20 cwt. or 10 large sacks	,,	1 ton.
21 tons 4 cwt.	,,	1 barge or keel.
20 keels, or 424 tons	,	1 ship load.
140 cwt. or 7 tons	,,	1 room.

The Newcastle chaldron is a weight of 53 cwt.

By the 1st and 2nd of William IV., it is directed that all coals be sold by weight instead of measure; 10 sacks of 224 lbs. each to one ton.

To calculate the weight of Cattle.—Measure round the animal close behind the shoulder, then along the back, from the fore part of the shoulder-blade to the bone at the tail. Multiply the square of the girt by five times the length, both expressed in feet. Divide the product by 21, and you have the weight of the four quarters, in stones of 14 lbs. In very fat cattle, the weight is about a twentieth more than that ascertained in this manner, while very lean ones weigh about a twentieth less. The quarters are little more than half the weight of the living animal. The skin weighs about the eighteenth, and the tallow about the twelfth of the whole.

Miscellaneous Liquid Measures.

Hogshead of Claret	46 gallons.
Butt of Sherry	108 „
Pipe of Port or Masden	115 „
Pipe of Madeira or Cape	92 „
Pipe of Teneriffe	100 „
Pipe of Lisbon or Bucellas	117 „
Butt of Tent, Malaga or Mountain	105 „
Aum of Hock, Moselle, and other German wines	30 „
Double aum of ditto	60 „
Pipe of Marsala or Bronti	93 „
Puncheon of Scotch Whisky	110 to 130 „
Puncheon of Brandy	110 to 120 „
Hogshead of Brandy	55 to 60 „
Puncheon of Rum	90 to 100 „

A hogshead is one-half
A quarter cask is one-fourth } of a pipe, butt or puncheon.
An octave is one-eighth

Money Table.

4 farthings	make	1 penny	(4 farthings).
12 pence	„	1 shilling	(48 farthings).
20 shillings	„	1 pound or sovereign	(960 farthings).

Other coins in use:—

A half-sovereign is 10 shillings.
A crown is 5 shillings.
A half-crown is 2 shillings and 6 pence.
A florin is 2 shillings.
A sixpence or tester is 6 pence.
A fourpenny piece or groat is 4 pence.
A threepenny piece or bit is 3 pence.
A halfpenny is half a penny or 2 farthings.

Former coins now out of circulation:—

Moidore . . .	27 shillings.
Jacobus . . .	25 „
Carolus . . .	23 „
Guinea . . .	21 „
Mark . . .	13 shillings and 4 pence.
Half-guinea . .	10 shillings and 6 pence.
Angel . . .	10 shillings.
Seven shilling piece .	7 shillings.
Noble . . .	6 shillings and 8 pence.

Proposed Decimal Coinage.

(The mil = 0·24 penny = 0·96 farthing).

10 mils	make	1 cent	(2·4 pence).
10 cents	„	1 florin	(24 pence).
10 florins	„	1 pound	(240 pence).

The mil, cent, and their multiples are the only new coins required.

This simple and uniform system will soon be generally understood, and its advantages are obviously so great that it must eventually come into operation.

Scotland and Ireland. In all bill or money transactions relating to Scotland or Ireland, it is requisite to insert or mention the word *sterling*, to indicate that the established money values of England are intended.

ABYSSINIA (AFRICA).

MEASURES.—The principal measure of length is the Turkish pic, which contains 26·8 English inches or 0·6804 metre of France.

The measure for grain is the ardeb:—

At Gondar, in the interior, the ardeb contains 10 madegas;
„ Massowah, on the Red Sea, „ „ 24 „ ;
and about 80 madegas make an English imperial bushel.

Weight.—The weights are the dirhem or drachm, the wakea or ounce, and the rottolo or pound:—

		ENGLISH VALUE.
10 drachms make	1 wakea	400 grains.
12 wakeas „	1 rottolo or liter	4800 grains or 10 troy ounces.
12 drachms „	1 mocha	480 grains or 1 oz. troy.

Money.—Coins of other countries are in circulation, amongst which may be mentioned Venetian sequins, Spanish dollars and imperial or Austrian dollars. The last are called patakas or patacks:—

23 harfs	make 1 pataka or dollar.	4*s.* 2*d.*
2¼ patakas	„ 1 sequin.	9*s.* 4½*d.*

Payments of large amount are usually made in ingots of gold, weighed by the wakea or Abyssinian ounce, containing 400 English grains. The pataka is also a money of account, of fluctuating value, and about 12 patakas are reckoned as the price of the wakea.

Aix-la-Chapelle; see Prussia.
Aleppo (Syria); see Ottoman Asia.
Alexandria; see Egypt.
Algiers (Africa); see France.
Alicante; see Spain.
Altona; see Denmark.

America; see United States.
Amsterdam; see Holland.
Ancona; see Roman States.
Antwerp; see Belgium.

ARABIA.

Measures.—At Mocha the long measures are the guz (25 English inches) and the cobido or covid (19 inches). The baryd (4 farsakh) is 12 English miles.

Liquids.

			ENGLISH VALUE.
16 vakias	make 1 noosfia		¼ imperial gallon.
8 noosfias	„ 1 gudda		2 „ gallons.

For dry measure, 40 mecmedas or kellas make the teman or tomand, which, in rice, weighs 168 lbs. avoirdupois.

Weights.

40 vakias	make 1 maund	3 lbs. avoirdupois.
10 maunds	„ 1 frazil	30 „ „
15 frazils	„ 1 bahar	450 „ „

Money.

80 caveers current make 1 piastre (*3s. 5d.* sterling).

Payments are however commonly made in Spanish dollars, valued at $1\frac{1}{5}$ piastre. The moneys coined in the country are commassees, which contain but little silver (only 7 carats), and pass at about 40 for the dollar, being used for small payments.

Archangel; see Russia.
Arragon; see Spain.
Athens; see Greece.
Augsburg; see Bavaria

AUSTRIA: VIENNA.

Length.

			ENGLISH VALUE.
12 punkte	make	1 linie	0·0864 inch.
12 linien	„	1 zoll	1·0371 „
12 zoll	„	1 fuss	12·445 inches or 1·0371 foot.
6 fuss	„	1 klafter	6·2226 feet or 2·0742 yards.
4000 klafter	„	1 meile	8297 yards or 4·7142 miles.

The elle is 30·66 English inches or 2·555 feet.

Surface.—A joch, or day's work, supposed to be as much ground as can be ploughed with one team in a day, is 1600 Vienna square klafters or fathoms = 6884 square yards or 1·4223 acre, and it is divided into 3 metzen.

Liquid Capacity.

2 pfiff	make	1 seidel	0·0779	imperial	gallons.
2 seidel	„	1 kanne	0·1557	„	„
2 kannen	„	1 mass	0·3114	„	„
10 mass	„	1 viertel	3·1143	„	„
4 viertel	„	1 eimer	12·4572	„	„
32 eimer	„	1 fuder	398·6304	„	„

Dry Capacity.

8 probmetzen	make	1 becher	0·0132	bushels.	
4 becher	„	1 futtermassel	0·0529	„	
2 futtermassel	„	1 muhlmassel	0·1057	„	
2 muhlmassel	„	1 achtel	0·2115	„	
2 achtel	„	1 viertel	0·4230	„	
4 viertel	„	1 metze	1·6918	„	
30 metzen	„	1 muth	50·7536	„	or 6·3442 quarters

Weight, Commercial.

4 pfennig	make	1 quentchen	67·5	grains	or 0·0096 lb.
4 quentchen	„	1 loth	270·2	„	0·0386 „
2 loth	„	1 unze	540·4	„	0·0772 „
4 unzen	„	1 vierding	2161·6	„	0·3088 „
2 vierding	„	1 mark	4323·2	„	0·6176 „
2 mark	„	1 pfund	8646·4	„	1·2352 „

Weight, Apothecaries'.

		ENGLISH VALUE.
20 gran	make 1 scrupel	22·52 grains or 0·0469 oz. troy
3 scrupel	,, 1 drachme	67·55 ,, 0·1407 ,,
8 drachmen	,, 1 unze	540·4 ,, 1·1258 ,,
12 unzen	,, 1 pfund	6484·8 ,, 13·510 ,,

The mark (4333 grains) is the unit of gold and silver weight and the apothecaries' pound = $1\frac{1}{2}$ mark.

Money.

	10 kreuzer piece	2·4 penny sterling.
100 new kreuzers	make 1 gulden or florin	24 pence or two shillings.
2 gulden	,, 1 thaler or rixdollar	4 shillings.

The gold ducat = 9*s.* 5*d.* sterling.
,, half-sovereign = 13*s.* 11*d.* ,,

The standard of money is called 20 guldenfuss, as 20 gulden are coined from the Cologne mark of fine silver.

Since 1876 the only legal measures and weights are those of the metric system of France ; see p. 75.

See also Bohemia and Venetian Lombardy.

BADEN (GERMANY).

Length.

10 punkte	make 1 linie	0·118 inches.
10 linien	,, 1 zoll	1·181 ,,
10 zoll	,, 1 fuss	11·811 ,, or 0·9842 feet.
10 fuss	,, 1 ruthe	118·110 ,, 9·8425 ,,

The ruthe is 3 French metres.

Surface.

100 square ruthen	make 1 viertel	9688 square feet or 0·2224 acre.
4 viertel	,, 1 morgen	38752 ,, ,, 0·8896 ,,

Liquid Capacity.

10 glass	make 1 mass	0·3501 gallons.
10 mass	,, 1 stütze	3·3014 ,,
10 stützen	,, 1 ohm	33·014 ,,
10 ohm	,, 1 fuder	330·140 ,,

The ohm is 15 French decalitres.

Dry Capacity.

			ENGLISH VALUE.
10 becher	make	1 mässlein	0·0413 bushels.
10 mässlein	„	1 sester	0·4127 „
10 sester	„	1 malter	4·1268 „ or 0·5158 quarters.
10 malter	„	1 zuber	41·2680 „ 5·1585 „

The malter is 15 French decalitres.

Weight.

10 ass	make	1 pfennig	7·7 grains.	
10 pfennig	„	1 centass	77·2 „	
10 centass	„	1 zehnling	772 „	or 0·1103 lb.
10 zehnling	„	1 pfund	7720 „	1·1029 „

The pfund is ½ French kilogramme.

The mark of Cologne (3609 grains troy) is used for weighing gold and silver.

For apothecaries' weight, see Nürnberg.

For the new imperial measures, weights, and moneys, now in use, see Germany, page 78, and France, page 75.

Barbadoes; see West Indies.

Barcelona; see Spain.

Basle, or Bâle; see Switzerland.

Batavia; see Java.

BAVARIA.

Length.

The Bavarian	foot	11·42 inches or 0·9517 feet.	
„ „	ell	32·796 „	2·7330 „
„ Augsburg	foot	11·65 „	0·9703 „
„ „	long ell	24·00 „	2·0000 „
„ „	short ell	23·32 „	1·9433 „
„ Nuremberg	foot	11·96 „	0·9967 „
„ „	ell	26·00 „	2·1667 „

Liquid Capacity.

The Bavarian	eimer	=	14·116 gallons.
„ Augsburg	mass	=	0·326 „
„ „	muid	=	15·080 „
„ Munich	eimer	=	8·122 „
„ Nuremberg	„ visirmass		14·963 „
„ „	„ schenkmass		13·964 „

Dry Capacity.

	ENGLISH VALUE.
The Bavarian scheffel	6·1172 bushels.
„ Augsburg „	12·087 „
„ „ „ (8 metzen)	5·650 „
„ Munich scheffel	9·976 „
„ Nuremberg malter	4·598 „

Weight.

The Bavarian pound	8642 grains or 1·2346 lb.
„ Augsburg mark	3643 „ 0·5204 „
„ „ heavy pound	7580 „ 1·0829 „
„ „ light „	7295 „ 1·0421 „
„ Munich pound	8656 „ 1·2366 „
„ Nuremberg mark	3670 „ 0·5243 „
„ „ pound	7870 „ 1·1243 „
„ „ old troy „	7360 „ 1·0514 „
„ „ apothecaries' „	5520 „ 0·7886 „

The Nuremberg apothecaries' pound is used for weighing medicines throughout Germany, and its subdivisions are the same as in England.—See Nürnberg.

Money (*Austrian standard*).

60 kreuzers make 1 florin	2*s.* sterling.
The rixdollar of 1800	4*s.* „
The florin of Nuremberg	20*d.* „

For the new imperial measures, weights, and moneys, now in use, see Germany, page 78.

BELGIUM.

The weights and measures are the same as those of France or Holland, though some of them are differently expressed, as aune for metre or ell, litron for litre or kannen, and livre for kilogramme or ponden.

Money.

100 centimes make { 1 franc	9·4*d.* sterling.
100 centimes make { 1 florin	20*d.* „

The value of Belgian money in francs is the same as that of France; and in florins, as well as the old Brabant money

in schillings and grotes, it is the same as that of Holland. In the division of the florin, the stiver is 5 cents, so that 20 stivers make the florin; and its value is about $2\frac{1}{9}$ francs.

Bengal; see East Indies.
Bergen; see Sweden and Norway.
Berlin; see Prussia.
Bermudas; see West Indies.
Berne; see Switzerland.

BIRMAH (ASIA): RANGOON.

Length.

The paulgaut is 1 inch English.
The taim or cubit is 18 inches.
The saundaung or royal cubit is 22 inches.
The dha or bamboo is 7 royal cubits = 154 inches.
The dain or Birman league is 1000 dhas = 2·4306 miles.

Weight.

			ENGLISH VALUE.
100 ticals or 3 catties	make	1 vis	$3\frac{1}{3}$ lbs. avoirdupois.
150 vis	„	1 candy	500 „ „

The Birmans, like the Chinese, keep their accounts decimally, and have no coin. Silver bullion and lead are the currency of the country.

BOHEMIA: PRAGUE.

The Prague foot measures 11·88 English inches; and the ell, 23·2 inches.

For the existing weights, measures and money, see Austria.

Bologna; see Roman States.
Bombay; see East Indies.
Bonn; see Prussia.
Bordeaux; see France.
Boston; see United States.

BRAZIL (SOUTH AMERICA).

The old weights and measures are, with the exceptions noticed below, the same as those of Portugal. The metric system of France has lately been adopted.

The medida	=	⅔ English imperial gallon.
,, alqueire	=	1·1004 imperial bushel.
	=	0·1378 ,, quarter.
,, mark	=	7·3781 ounces troy.

The rate of exchange for government estimates is 27 pence to the milreis (paper currency). At this rate of exchange to reduce milreis to English pounds, divide by 10 and to the quotient at its ⅛th part.

For further information, see Portugal.

BREMEN (GERMANY).

Length.

	ENGLISH VALUE.
10 linien make 1 zoll (inch)	0·95 inches.
12 zoll ,, 1 fuss (foot)	11·38 ,, or 0·9483 feet.
2 fuss ,, 1 elle (ell)	22·76 ,, 1·8967 ,,
8 ellen ,, 1 ruthe (rood)	15·174 feet or 5·058 yards.
The klafter is 3 ellen	5·69 feet.
The meile is 20,000 Rhenish feet	6865 yards or 3·9006 miles.

Surveyors divide the fuss decimally.

Surface.

The morgen is 120 square ruthen (3070 square yards or 0·6343 acre).

Liquid Capacity.

4 mingel make 1 quartier	0·1772 gallons.
9 quartier ,, 1 viertel	1·5953 ,,
5 viertel ,, 1 anker	7·9763 ,,
4 anker ,, 1 ohm	31·9052 ,,
6 ohm ,, 1 fuder	191·4315 ,,
The stübchen (gallon) is 4 quartier	0·709 ,,
,, oxhoft (hogshead) is 6 anker	47·858 ,,

Dry Capacity.

		ENGLISH VALUE.
4 spinte	make 1 viertel	0·5094 bushels.
4 viertel	,, 1 scheffel	2·0377 ,,
40 scheffel	,, 1 last	81·5088 ,, or 10·1886 quarters.

Weight.

4 ort	make 1 quentchen	60·1 grains or 0·1373 oz.
4 quentchen	,, 1 loth	240·3 ,, 0·5493 ,,
2 loth	,, 1 unze	480·6 ,, 1·0986 ,,
8 unzen	,, 1 mark	3845 ,, 0·5493 lb.
2 mark	,, 1 pfund	7690 ,, 1·0986 ,,

Gold and silver are weighed by the mark of Cologne (3609 grains troy). For apothecaries' weights, see Nürnberg.

Money.

5 schwaren make 1 grot		0·55*d.* sterling.
72 grot ,,	1 rixdollar or thaler	39·4*d.* ,,
48 grot (silver piece)		27*d.* ,,

For the new imperial measures, weights, and moneys, now in use, see Germany, page 78.

British Islands; see Great Britain.

BRITISH POSSESSIONS IN NORTH AMERICA.

Throughout the United Canadas, New Brunswick, Nova Scotia, Prince Edward's Island, Newfoundland and the territories of the Hudson's Bay Company, the weights and measures are those of Great Britain, but generally with the old measures of capacity in wine gallons and Winchester bushels, and therefore the same as in the United States.

The moneys of account are either in pounds, shillings and pence sterling, in the same denominations of money in a nominal currency, or in dollars and cents.

According to the Halifax currency, which prevails throughout these provinces, the Spanish or American dollar is valued at 5*s.* or 60*d.* currency, and what is called sterling is the

valuation of the dollar at the former standard of 4*s.* 6*d.*, and between this and the Halifax currency, the proportion is as 9 to 10, making 90*l.* nominal sterling (in dollars at 4*s.* 6*d.*) equal to 100*l.* in Halifax currency.

But if the sterling value of the dollar be estimated at 4*s.* 2*d.*, the par of exchange should be 83*l.* 6*s.* 8*d.* nominal sterling for 100*l.* Halifax currency, the same being in the proportion of 5 to 6. This proportion exists in New Brunswick. In Canada and Nova Scotia it is 4 to 5. In Newfoundland the dollar passes for 5*s.*, and its assumed value is 4*s.* 4*d.* sterling, making the par of exchange 86*l.* 13*s.* 4*d.* nominal sterling for 100*l.* currency, being in the proportion of 13 to 15; but as the dollar is here overrated as to its sterling value, bills on England usually bear a premium of about 5 per cent.

The decimal coinage of the United States has been recently adopted.

In Lower Canada, wheat is measured by the minot, an old French measure (1·0736 imperial bushel). Land is measured by the arpent, another old French measure (0·8449 acre).

BRUNSWICK (GERMANY).

Length.

	ENGLISH VALUE.
12 zoll make 1 schuh (shoe or foot)	11·23 inches or 0·9358 feet.
2 schuh „ 1 elle	22·46 „ 1·8717 „
The meile (34424 Rhineland feet) =	11816 yards or 6·7140 miles.

Surface.

The morgen (30720 square schuh) = 26904 square feet or 0·6176 acre.

Liquid Capacity.

2 nössel make 1 quartier	0·205 gallons.	
4 quartier „ 1 stübchen	0·82 „	
40 stübchen „ 1 ohm	32·80 „	
The fuder (4 oxhoft) of wine = 240 stübchen		196·8 gallons.
The fass (4 tonnen) of beer = 108 „		88 56 „

Dry Capacity.

			ENGLISH VALUE.
4 becher or löchers	make	1 vierfass	0·2139 bushels.
4 vierfass	,,	1 himt	0·8556 ,,
10 himt	,,	1 scheffel	8·5560 ,, or 1·0695 quarter.

Weight.

2 heller	make	1 pfennig	14·1 grains.	
4 pfennig	,,	1 quentchen	56·3 ,,	
4 quentchen	,,	1 loth	225·3 ,,	or 0·515 oz.
16 loth	,,	1 mark	3605 ,,	0·515 lb.
2 mark	,,	1 pfund	7210 ,,	1·030 ,,

The liespfund is 14 Brunswick pfund	14·42 lbs.
The centner ,, 114 ,, ,,	117·42 ,,
The schiffpfund (ship-pound) is 20 liespfund	288·40 ,,

Gold and silver are weighed by the mark of Cologne (3609 grains troy).

For apothecaries' weights, see Nürnberg.

For the new imperial measures, weights, and moneys, now in use, see Germany, page 78.

Brussels; see Belgium.

Cadiz; see Spain.

Cairo; see Egypt.

Calcutta; see East Indies.

Canada; see Great Britain, and British Possessions in North America.

Ceylon; see East Indies.

CANARY ISLANDS (IN ATLANTIC).

The measures, weights, and coins are from Spain, but several of them are somewhat variable and depreciated in value.

For long measure the pié is the Castilian foot (11·128 English inches).

The standard libra, or pound, is 1·0148 lb. avoirdupois.

CANDIA (IN MEDITERRANEAN).

		ENGLISH VALUE.
The pic or ell	=	25·11 inches.
The mistate (for oil)	=	2·456 gallons.
The carga (for corn)	=	4·189 bushels.
The cantaro of 100 rottoli or 44 occas	=	116½ lbs.
40 paras make 1 piastre		2¼*d.* sterling.

Canton; see China.

CAPE OF GOOD HOPE (BRITISH COLONY).

For measures and weights, see Great Britain, page 44.

Money.—British currency is also used; and occasionally the former Dutch currency, according to which,

6 stivers	make 1 skilling	2¼*d.* sterling.
8 skillings	„ 1 rixdollar	18*d.* „

Cape Verd Islands (in Atlantic); see Portugal.

Cassel (Germany); see Hesse Cassel.

Castile; see Spain.

CEYLON (INDIA): COLUMBO.

The parrah is 5·62 gallons; and the seer 1 quart.
The candy or bahar weighs 500 lbs. avoirdupois.

Measures of length and surface are the same as in England.

Since 1825, by order in council, the public accounts are kept in British money, with the following values of the coin in circulation:—

The rixdollar	1*s.* 6*d.* sterling.
The Spanish dollar	4*s.* 2*d.* „
The Sicca rupee	2*s.* „
The rupee of Madras and Bombay .	1*s.* 10*d.* „

But the Sicca rupee has superseded the sterling currency in all commercial transactions.

Christiana; see Sweden and Norway.

CHINA.

Length.

	ENGLISH VALUE.
10 fêns make 1 tsun	1·41 inches.
10 tsuns „ 1 chik or covid	14·1 „
10 chiks „ 1 cheüng or fathom	141 „ or 11·75 feet.
10 cheüngs „ 1 yin	117·5 feet.
Surveyors and engineers' chik	12·70 inches.
Itinerary „	12·17 „
Pekin „	13·12 „
Canton (commercial) „	14·70 „
Imperial „	12·612 „

The li or mile (1800 itinerary chiks) = 1826 English feet.

Capacity.

10 kops make 1 shing tsong	0·12 gallons or 0·96 pints.
10 shings „ 1 tau (12 catties)	1·2 „ 9·6 „
10 taus „ 1 hwŭh	12·0 „ 96·0 „

The measures of dry capacity are nearly $\frac{1}{3}$ greater than these.

Weight.

16 taels make 1 catty or pound	1⅓ avoirdupois lbs.
100 catties „ 1 pecul or tan	133⅓ „ „

Therefore the tael or ounce (10 mace) = $\frac{1}{1\frac{1}{2}}$lb. or 583 grains.

Money.

10 cash ("le") make 1 candereen ("fun")	¾*d.* sterling.
10 candereens „ 1 mace ("tsëen")	7 *d.* „
10 mace „ 1 tael ("lëang")	70*d.* „

These moneys, excepting the cash, are imaginary, and are formed from weights of Sysee silver, under the same denominations; and the tael in the money and commercial weights are alike. The touch or fineness of Sysee silver is 0·980. The cash are casts of common metal with a square hole in the middle, through which they are strung like beads in various numbers. Silver ingots from ½

to 100 taels are used as money; but gold is considered as merchandise, and is sold in ingots, called shoes. If the metals be sysee or pure, 10 taels of silver are given for 1 of gold.

Coblentz; see Prussia.

COLOGNE (PRUSSIA).

In 1816 a uniform system of weights and measures was decreed for all the Prussian dominions, for which see Prussia. The Rhineland foot was adopted as the standard unit for measures of length, and the Cologne mark as the unit for weights. As the system of weights previously established at Cologne is still in use throughout Germany, it is here inserted for reference.

Weight.

			ENGLISH VALUE.		
4 pfennig	make	1 quentchen	56·4 grains.		
4 quentchen	,,	1 loth	225·56	,,	
2 loth	,,	1 unze	451·12	,,	
8 unzen	,,	1 mark	3609	,,	or 0·51557 lb.
2 mark	,,	1 pfund	7218	,,	1·03114 ,,

The standard copy of the Cologne mark in use at Hamburg has been ascertained to weigh 3608 English grains, being 1 grain lighter than the average of the Prussian standards.

For the new imperial measures, weights, and moneys, now in use, see Germany, page 78.

Constantinople; see Turkey.

Copenhagen; see Denmark.

Corsica (in Mediterranean); see France.

CRACOW (POLAND).

The Cracow foot = 14·032 inches or 1·1693 foot.

Cremona (Italy); see Venetian Lombardy.

Cuba; see West Indies.

Damascus; see Ottoman Asia.

Dantzic; see Prussia.

Demerara; see West Indies.

DENMARK.

Length.

		ENGLISH VALUE.
12 linien	make 1 tomme	1·03 inches.
12 tommen	„ 1 fod	12·357 „ or 1·0298 feet.
2 fod	„ 1 aln	24·714 „ 2·0595 „
The miil is 12000 aln		24,714 feet or 4·6807 miles.

Liquid Capacity.

	pott =	0·2126 gallons.
2 pott	make 1 kande	0·4252 „
2 kanden	„ 1 stübchen	0·8504 „
2 stübchen	„ 1 viertel	1·7008 „
$4\frac{7}{8}$ viertel = 39 pott	„ 1 anker	8·2914 „

Dry Capacity.

	pott =	0·02657 bushels.	
18 pott	make 1 skieppe	0·47835 „	
2 skieppen	„ 1 fjerding	0·9567 „	or 0·1196 quarter
4 fjerding	„ 1 tonne	3·8268 „	0·47835 „
22 tonnen	„ 1 last	84·188 „	10·5235 „

The liquid and dry pott measures are identical in capacity.

Weight.

4 ort	make 1 quintin	60·3 grains or 0·1378 oz.	
4 quintin	„ 1 lod	241·2 „	0·5514 „
2 lod	„ 1 unze	482·5 „	1·1029 „
8 unzen	„ 1 mark	3860 „	0·5514 lb.
2 mark	„ 1 pund	7720 „	1·1029 „
The lispund is 16 pund		17·646 lbs.	
The skippund is 20 lispund		352·914 „	or 3·151 cwt.

For gold and silver the pound is 7266 English grains, and is divided the same as the preceding.

The metric system of measures and weights is now being adopted.

Money.

		ENGLISH VALUE.
16 skillinge make 1 mark		4·4*d.* sterling.
6 mark „ 1 { rigsbank or rix-banco } dollar		26·35*d.* „
The Danish specie dollar	=	51·4*d.* „

Since 1873 the monetary system has been—

100 öre make 1 kronor	1*s.* 1·3*d.* sterling.

Dresden ; see Saxony.

EAST INDIES.

1. BENGAL : CALCUTTA.

Length.

3 jows or barleycorns make 1 unglee or finger		¾ inch.
4 unglees „ 1 moot or hand		3 inches.
3 hands „ 1 span		9 „
2 spans „ 1 haut or cubit		18 „
2 cubits „ 1 guz or yard		36 „ or 3 feet
2 yards „ 1 fathom		6 feet.
1000 fathoms „ { 1 Bengal coss or mile }		6000 „ or $1\frac{3}{22}$ mile.

Liquids and grain are measured by weight.

Weight.

		FACTORY.	BAZAAR.
5 siccas make 1 chittack		0·1167 lbs.	0·1283 lbs.
16 chittacks „ 1 seer		1·8667 „	2·0533 „
40 seers „ 1 maund		74·667 „	82·133 „
30 maunds	=	20 cwt.	22 cwt

These are the avoirdupois values of the Factory and Bazaar weights, the latter being 10 per cent. heavier than the former. The new Indian sicca weight or tola (180 grains), established in 1833, is $\frac{1}{3}$ grain heavier than the above, and it corresponds with the weight of the Company's silver rupee, and also with that of the gold mohur.

Money.

12 pie or pice make 1 anna	1·4*d.* sterling.
16 annas „ 1 Company's rupee	22·4*d.* „
The Sicca rupee =	23·3*d.* „
The gold mohur of 16 sicca rupees	32*s.* „

80 silver rupees, or 36 copper annas, weigh 80 new Indian tolas, or 1 seer, which proportions suggest a ready and available means of testing the correctness of the Bazaar weights.

2. MADRAS.

Length.—The covid for cloth measure is 18·6 inches; but the English yard is generally used.

Capacity.

			ENGLISH VALUE.
8 ollucks	make 1 measure or puddy		0·338 gallons.
8 measures	„ 1 marcal		2 704 „
5 marcals	„ 1 parah or chunam		13·52 „
80 parahs	„ 1 garce, weighing 8400 lbs.		135·2 bushels or 16·9 quarters

Weight.

10 pagodas	make 1 pollam	0·078 lbs. avoirdupois.
8 pollams	„ 1 seer	0·625 „ „
5 seers	„ 1 vis	3·125 „ „
8 vis	„ 1 maund	25 lbs.
20 maunds	„ 1 candy	500 „

Money.—Same as Bengal.

3. BOMBAY.

Length.

16 tussoos	make 1 hath	18 inches.
24 tussoos	„ 1 guz	27 „

Capacity.

16 adoulies	make 1 parah	3·03 bushels.
8 parahs	„ 1 candy	24·24 „

Weight.

30 pice or 72 tanks	make 1 seer	0·7 lbs.
40 seers	„ 1 maund	28 lbs. or ¼ cwt.
20 maunds	„ 1 candy	560 „ 5 „

Money.

100 reas	make 1 quarter	5·6*d.* sterling.
4 quarters or 16 annas	„ 1 rupee	22·4*d.* „

The gold mohur or 15 rupee piece is of the same weight and purity as the silver rupee, 15 alloy and 165 fine grains, and its value at the British mintage rate is 1*l.* 9*s.* 2*d.* The gold pagoda star is valued at 7*s.* 4*d.* sterling.

A lac is 100,000 and a crore is 10 millions of rupees.

At Singapore the Spanish dollar circulates at 2·18 rupees or 4*s.* 1*d.* sterling.

See also Ceylon.

EGYPT (AFRICA).

Length.—4 derahs make 1 gasab (2·832 English yards).

The principal measure for cloth and silk is the pic (26·8 English inches).

Ancient Measures.

The natural cubit (24 Egyptian fingers) is 17·71 inches.
„ royal „ (28 „ „) 20·66 „

Surface.—The feddan al risach, or acre, is 400 square gasab = 3208 square yards or 0·6628 acre.

Capacity.—24 robs make 1 ardeb (4·9 imperial bushels or 0·6125 quarter).

Weight.

	ENGLISH VALUE.
144 drachmas or meticals make 1 rotl or pound	1·008 lbs.
100 rottoli „ 1 cantaro	100·8 „
The oke is 400 drachmas	2·8 „

Money.—40 paras make 1 piastre (2¼*d.* sterling).

Elsinore; see Denmark.
England; see Great Britain.
Falkland Islands; see Great Britain.
Finland; see Russia.
Flanders; see Belgium.
Florence; see Tuscany.

FRANCE.

1. METRICAL SYSTEM NOW IN USE.

Length.

	ENGLISH VALUE.
Millimètre (1000th of a mètre)	0·03937 inches.
Centimètre (100th of a mètre)	0·39371 ,,
Décimètre (10th of a mètre)	3·93708 ,,
Mètre (unit of length)	39·3708 ,, or 3·2809 feet.
Décamètre (10 mètres)	32·809 feet. 10·9363 yards.
Hectomètre (100 mètres)	328·09 ,, 109·3633 ,,
Kilomètre (1000 mètres)	1093·63 yards or 0·62138 miles.
Myriamètre (10,000 mètres)	10936·33 ,, 6·21382 ,,

Surface.

Centiare	(100th of an are or a square mètre)	1·1960 square yards.
Are	(square décamètre and unit of surface)	119·6032 ,, ,, or 0·0247 acres.
Decare (10 ares)		1196·033 ,, ,, 0·2474 ,,
Hectare (100 ares)		11960·33 ,, ,, 2·4736 ,,

Capacity.

Millitre	(1000th of a litre or cubic centimètre)	0·06103 cubic inches.
Centilitre (100th of a litre)		0·61027 ,, ,,
Décilitre (10th of a litre)		6·10270 ,, ,,
Litre	(cubic decimètre and unit of capacity)	61·02705 ,, ,, or 1·7608 pints.
Décalitre (10 litres)		610·2705 ,, ,, 2·2010 gallons.
Hectolitre (100 litres)		3·53166 cubic feet 22·0097 ,,
Kilolitre	(1000 litres or cubic mètre)	35·31658 ,, ,, 220·0967 ,,
Myrialitre (10,000 litres)		353·1658 ,, ,, 2200·9667 ,,

Solid.

Décistère (10th of a stère)	3·5317 cubic feet.
Stère (cubic mètre)	35·3166 ,, ,,
Décastère (10 stères)	353·1658 ,, ,,

Weight.

		ENGLISH VALUE.
Milligramme	(1000th of a gramme)	0·0154 grains.
Centigramme	(100th of a gramme)	0·1544 „
Décigramme	(10th of a gramme)	1·5440 „
Gramme	(unit of weight)	15·44 „
Décagramme	(10 grammes)	154·4 „
Hectogramme	(100 grammes)	1544 grains = 3·2167 oz. troy, or 3·5291 oz. avoirdupois.
Kilogramme	(1000 grammes)	32⅛ oz. troy or 2·2057 lbs. „
Myriagramme	(10000 grammes)	321⅝ „ 22·057 „ „

The foregoing metric system is now adopted in Austria, Belgium, Greece, Holland, Germany, Italy, Norway, Portugal, Spain, Sweden, and Switzerland.

2. "Systeme Usuel."

(Formerly in use, but interdicted since 1840).

Length.

12 lignes make 1 pouce	1·094 inches.
12 pouces „ 1 "pied usuel"	13·124 „ or 1·0936 feet.
3 pieds „ 1 mètre	39·371 „ 3·2809 „
2 mètres „ 1 toise	78·742 „ 6·5618 „
The aune is 12 decimétres = 1⅕ mètre	47·245 „ 3·9371 „

Weight.

72 grains make 1 gros	60·31 grains troy.
8 gros „ 1 once	482·5 „ = 1·0052 oz. troy.
8 onces „ 1 mark	3860 „ = 8·0417 „
2 marks „ 1 livre = 500 grammes	7720 „ = 1·3403 lb. troy, or 1·1029 „ avoird.

3. ANCIENT SYSTEM.

Length.

12 lignes make 1 pouce or inch	1·066 inches.
12 pouces „ 1 "pied de Roi" (0·3249 mètre)	12·79 „
6 pieds „ 1 toise (1·9492 „)	6·395 feet.
The aune (1·1880 „)	46·85 inches.
"Lieue de poste" (2000 toises)	4263 yards or 2 4222 miles.

Weight.

		ENGLISH VALUE.
72 grains make 1 gros		59·0 grains troy.
8 gros „ 1 once		472·2 „ „ =0·9837 oz. troy.
8 onces „ 1 mark		3777·5 „ „ =7·8698 „
2 marks „ 1 poids de marc		7555 „ „ 1·3116 lb. troy, or 1·0793 „ avoirdupois.

Money.

10 décimes / 100 centimes make 1 franc	9·4*d.* sterling.
5 franc piece in silver	3*s.* 11*d.* „
10 franc piece in gold	7*s.* 11*d.* „
20 franc piece or Napoleon	15*s.* 10*d.* „

There are gold coins of 5, 10, 20, 50, and 100 francs, and silver coins of 1, 2, and 5 francs; also bronze coins of 1, 2, 5, and 10 céntemes.

FRANKFORT-ON-THE-MAINE (GERMANY).

Length.

The foot measures 11 27 English inches, and the ell 21·54 inches.

Liquid Capacity.

4 eich-mass / 4½ neu-mass make 1 viertel	1·5784 gallons.
20 viertel „ 1 ohm	31·5674 „
6 ohm „ 1 fuder	189·4044 „

The mass is also divided into 4 schoppen.

Dry Capacity.

1 achrot make 1 mässchen	0·01233 bushels.
4 mässchen „ 1 gescheid	0·04932 „
4 gescheid „ 1 sechter	0·1973 „
2 sechter „ 1 metze	0·3946 „
2 metzen „ 1 simmer	0·7892 „
4 simmer „ 1 malter or achtel	3·1568 „

Weight.

		ENGLISH VALUE.
2 heller	make 1 pfennig	14·1 grains or 0·0322 oz.
4 pfennig	„ 1 quentchen	56·4 „ 0·1289 „
4 quentchen	„ 1 loth	225·6 „ 0·5157 „
2 loth	„ 1 unze	451·2 „ 1·0314 „
8 unzen	„ 1 mark	3610 „ 0·5157 lb.
2 mark	„ 1 pfund	7220 „ 1·0314 „

The heavy weight is 8 per cent. more than this table; and the zoll-centner is 110·24 lbs. avoirdupois.

Apothecaries' weight is the same as at Nürnberg.

Money.

The gold ducat is about 9*s.* 4*d.* sterling.

For the imperial measures, weights, and moneys, now in use, see Germany (below).

Frankfort-on-the-Oder; see Prussia.

Gallen, St. Gall; see Switzerland.

Geneva; see Switzerland.

Genoa; see Sardinia.

GERMANY.

See Austria, Baden, Bavaria, Bohemia, Bremen, Brunswick, Cologne, Frankfort, Hamburg, Hanover, Hesse, Lubeck, Prussia, and Saxony.

The measures and weights throughout Germany are now those of the metric system, the meter or stab (staff or ell) and the kilogramme being the principal units; the millimeter is also denominated strich (linie); see France, p. 75.

The present imperial monetary system for the whole of Germany is—

100 pfennige make 1 Reichs-mark | 1*s.* sterling.

GIBRALTAR.

The weights and measures are those of Great Britain.

Money.

10 decimas	make 1 real vellon	2·5*d.* sterling.
20 reals	„ 1 dollar (Spanish)	4*s.* 2*d.* „
16 dollars	„ 1 doubloon (Spanish)	66*s.* 8*d.* „

The Spanish hard dollar is a legal tender at this rate in all the British Colonies. By an order in council, issued in 1845, it was directed that Spanish, Mexican, and South American dollars shall be legal tenders at 4*s.* 2*d.* sterling; and that gold doubloons, or 16 dollar pieces, of the same countries, shall pass for 3*l.* 6*s.* 8*d.* Mercantile operations are carried on in dollars and cents.

Great Britain; see page 44.

GREECE.

Length.

	ENGLISH VALUE.
The short picha (used for silks)	25 inches.
„ long „ (woollens and linens)	27 „
Ancient Greek foot (16 Egyptian fingers)	11·81 „
„ Attic or Olympic foot	12·10 „
„ Pythic foot	9·75 „

The cubit is $1\frac{1}{2}$ feet and the stadium 400 cubits or 600 feet.

Capacity.

The kila measures 0·9152 bushel or 0·1144 quarter.
The staro, of 3 bachels, measures 2·259 bushels.
The ancient keramion or metretes is 8·488 gallons.

Weight.

The pound is 6168 grains or 0·8811 lb. avoirdupois.
The cantaro, of 40 okes, is 112 lbs. or 1 cwt.

The French metric system is now uniformly established, only with a different nomenclature; see p. 75.

Money.

The silver drachma (=100 lepta or centimes)	8·4*d.* sterling.
The 5 drachma silver piece	3*s.* 6*d.* „
The 10 drachma „ „	7*s.* 0*d.* „
The 20 drachma gold piece	14*s.* 2*d.* „

GUINEA (AFRICA).

Length.—The jacktan = 12 English feet.

Weight.

	ENGLISH VALUE.
2 media-tabla make 1 aguīrage	62 grains.
2 aguīrages „ 1 piso or uzan	124 „
4 pisos „ 1 benda-offa	496 „
2 benda-offas „ 1 benda	992 „
The quinto is 3 media-tabla	93 „
„ seron „ 6 „ „	186 „
„ eggēba „ 10⅔ „ „	330 „

Money.—100 cents make 1 dollar (50*d.* sterling).

The decimal system was introduced in 1839, the previous money being that of Holland, of which 3 guilders were to represent 1 dollar currency.

HAMBURG (GERMANY).

8 achtel make 1 zoll	0·94 inches.
12 zoll „ 1 fuss	11·29 „ or 0·9408 feet.
2 fuss „ 1 elle	22·58 „ 1·8817 „ or 0·6272 yard.
The Rhenish foot	12·357 „ 1·0298 feet.

Engineers and surveyors use the Rhenish foot and inch, decimally divided.

The meile is 24000 Rhenish feet = 4·6807 English miles.

Surface.—The morgen is 117600 square fuss = 2·3895 acres.

Liquid Capacity.

2 össel make 1 quartier	55·2 cubic inches or 0·1992 gallons.
2 quartier „ 1 kanne	110·4 „ „ 0·3983 „
2 kannen „ 1 stübchen	220·9 „ „ 0·7967 „
2 stübchen „ 1 viertel	441·8 „ „ 1·5934 „
5 viertel „ 1 anker	2209 „ „ 7·9668 „
4 anker „ 1 ohm	8836 „ „ 31·867 „
6 ohm „ 1 fuder	53016 „ „ 191·292 „
The eimer is 4 viertel	6·3734 gallons.
The tonne is 24 „	38·2404 „
The oxhoft is 30 „	47·8006 „

Dry Capacity.

		ENGLISH VALUE.
4 spint.	make 1 himt	1606·5 cubic inches or 0·7242 bushels.
2 himt	„ 1 fass	3213 „ „ 1·4485 „
2 fass	„ 1 scheffel	6426 „ „ 2·8969 „
10 scheffel	„ 1 wispel	64260 „ „ 28·9694 „
3 wispel	„ 1 last	192780 „ „ 86·9083 „ or 1·0864 lasts.

Weight.

4 pfennig	make 1 quentchen	58·4 grains.	
4 quentchen	„ 1 loth	233·6 „	
2 loth	„ 1 unze	467·2 „	or 1·068 oz.
8 unzen	„ 1 mark	3738 „	8·544 „
2 mark	„ 1 pfund	7476 „	1·068 lbs.

The schiffpfund or 20 liespfund is 280 pfund.

Gold and silver are weighed by the Cologne mark; and medicine by Nürnberg apothecaries' weight.

Money.

12 pfennige	make 1 schilling	0·9*d.* sterling.
16 schillinge	„ 1 mark	1*s.* 2½*d.* „
3 mark / 48 schillinge	1 rixdollar (nominal)	3*s.* 7*d.* „
The mark banco (imaginary)		1*s.* 5½*d.* „
The rixdollar specie		4*s.* 5·7*d.* „
The gold ducat		9*s.* 4*d.* „

The weight of the Cologne mark, according to the Hamburg standard, is 3608 English troy grains. This weight of *fine* silver is coined into 34 marks, and its value, at the rate of 5*s.* sterling per ounce standard, is 40*s.* 7*d.*; hence the value of the "mark current" as above. Banco is a nominal valuation of the Cologne mark of silver at 27¾ marks Banco, according to which the estimated value of the "mark banco" is 17½*d.* sterling.

For the new imperial measures, weights, and moneys, now in use, see Germany, p. 78.

HANOVER (GERMANY).

Length.

		ENGLISH VALUE.
12 linien = 8 achtel	make 1 zoll	0·95 inches.
12 zoll	„ 1 fuss	11·45 „ or 0·9542 feet.
2 fuss	„ 1 elle	22·9 „ 1·9083 „
3 ellen	„ 1 ruthe	183·2 „ 15·2667 „
The meile (25,400 fuss) =		24236 feet 4·5901 miles.

Surface.—The morgen of Calenberg is 30720 square fuss = 3108 square yards or 0·6438 acre.

Liquid Capacity.

2 nössel	make 1 quartier	0·214 gallons.
2 quartier	„ 1 kanne	0·428 „
2 kannen	„ 1 stübchen	0·856 „
2 stübchen	„ 1 viertel	1·7118 „
5 viertel	„ 1 anker	8·559 „
4 anker	„ 1 ohm	34·236 „
6 ohm	„ 1 fuder	205·416 „
The eimer is	8 viertel	13·6944 „
The oxhoft is	30 viertel	51·354 „

Dry Capacity.

4 vierfass = 3 drittel	make 1 himt	0·8556 bushels.
6 himt	„ 1 malter	5·1337 „ or 0·6417 quarters.
8 malter	„ 1 wispel	41·07 „ 5·1337 „
2 wispel	„ 1 last	82·14 „ 10·2675 „

Weight.

4 örtchen	make 1 quentchen	58·7 grains or 0·1341 oz.
4 quentchen	„ 1 loth	234·8 „ 0·5366 „
2 loth	„ 1 unze	469·5 „ 1·0731 „
8 unzen	„ 1 mark	3756 „ 0·5366 lb.
2 mark	„ 1 pfund	7512 „ 1·0731 „

Gold and silver are weighed by the Cologne mark; and medicine by Nürnberg apothecaries' weight.

For the new imperial measures, weights, and moneys, now in use, see Germany, p. 78.

Havannah; see West Indies.

Hayti or Haiti (St. Domingo); see West Indies.

HESSE-CASSEL (GERMANY).

Length.

	ENGLISH VALUE.
12 linien make 1 zoll	0·9437 inches.
12 zoll „ 1 (standard) fuss	11·324 „ or 0·9437 foot.
The (surveyors') fuss	11·217 „ 0·9347 „

Surface.—The acker (29400 square surveyors' fuss) = 2854 square yards or 0·5897 acre.

Liquid Capacity.

4 schoppen make 1 mass	0·44 gallons.
4 mass „ 1 viertel	1·76 „
20 viertel „ 1 ohm	35·2 „
6 ohm „ 1 fuder	211·2 „

Dry Capacity.

4 mässchen make 1 metze	0·276 bushels.
4 metzen „ 1 himt	1·105 „
2 himt „ 1 scheffel	2·21 „

Weight.

4 quentchen make 1 loth	234 grains or 0·535 oz.
2 loth „ 1 unze	468 „ 1·07 „
16 unzen „ 1 pfund	7490 „ 1·07 lb.

Gold and silver by the Cologne mark; and apothecaries' weight the same as at Nürnberg.

For the new imperial measures, weights, and moneys, now in use, see Germany, p. 78.

HESSE-DARMSTADT (GERMANY).

Length.

10 linien make 1 zoll	0·984 inches.
10 zoll „ 1 fuss	9·843 „ ($\frac{1}{4}$ French metre).
10 fuss „ 1 klafter	98·427 „ = 8·2022 feet or 2·7341 yards.

Surface.—The morgen is 40,000 square fuss or 400 square klafter = 2990 square yards or 0·6178 acre.

Liquid Capacity.

			ENGLISH VALUE.
4 schoppen	make	1 mass	0·44 gallons.
4 mass	„	1 viertel	1·76 „
20 viertel	„	1 ohm	35·2 „
6 ohm	„	1 fuder	211·2 „

Dry Capacity.

4 mässchen	make	1 gescheid	0·055 bushels.
4 gescheid	„	1 kümpf	0·22 „
4 kümpf	„	1 simmer	0·88 „
4 simmer	„	1 malter	3·52 „

Weight.

4 pfennig	make	1 quentchen	60·3 grains.	
4 quentchen	„	1 loth	241·1 „	or 0·5511 oz.
32 lothe	„	1 pfund	7716 „	1·1023 lb.

Previously to 1821 the weights and measures were those of Frankfort.

For the new imperial measures, weights, and moneys, now in use, see Germany, p. 78.

Hindoostan (Asia); see East Indies.

HOLLAND.

With the exception of the old nomenclature, the weights and measures of Holland, since 1817, have been according to the metric system of France.

Length.

The streep	is the	millimètre	0·03937 inches.	
„ duim	„	centimètre	0·39371 „	
„ palm	„	decimètre	3·93708 „	
„ elle	„	mètre	39·3708 „	or 3·2809 feet.
„ roede	„	décamètre	32 809 feet or	10·9363 yards.
„ mijle	„	kilomètre	1093·63 yards or	0·6214 mile.

Liquid Capacity.

The vingerhoed	is the centilitre	0·61027 cubic inches.	
„ maatje	„ decilitre	6·10270 „	„
„ kan	„ litre	61·02705 „	„ or 1·7603 pints.
„ vat	„ hectolitre	3·53166 cubic feet	or 22·0097 gallons.

Dry Capacity.

The maatje	is the decilitre	6·10270 cubic inches.	
„ kop	„ litre	61·02705 „	„
„ schepel	„ decalitre	610·2705 „	„ or 0·27512 bushels.
„ mudde or zak	„ hectolitre	3·53166 cubic feet	or 2·7512 „
„ last	is 30 mudde	82·536 bushels	or 10·317 quarters or 1·0317 last imperial.

Weight.

The korrel	is the decigramme	1·544 grains.	
„ wigtje	„ gramme	15·44 „	
„ lood	„ decagramme	154·4 „	
„ ons	„ hectogramme	1544 „	or 3·5291 oz.
„ pond	„ kilogramme	15440 „	2·2057 lbs.

Apothecaries' weight is similar to that of Great Britain.

Money.

	ENGLISH VALUE.
5 cents make 1 stiver	1*d.* sterling.
20 stivers / 100 cents = 1 florin or guilder	1*s.* 8*d.* „
The rixdollar (nominal) is 50 stivers / 2½ florins	4*s.* 2*d.* „
12 groot make 1 schilling Flemish	6*d.* „
The ducatoon	5*s.* 5*d.* „
The gold ducat	9*s.* 5*d.* „
„ „ 10 florin piece	16*s.* 6½*d.* „
„ „ ryder	25*s.* 1*d.* „

Holstein; see Denmark.

Hungary; see Austria.

IONIAN ISLANDS (IN MEDITERRANEAN).

Since 1817, the weights and measures have been those of Great Britain with Italian designations.

The libbra sottile is the pound troy; the libbra grossa the pound avoirdupois; the centinajo is 100 libbre.

The dicotoli is the English pint; the chilo the bushel; the barile is 16 gallons; the stadio is the chain (22 yards), &c.

Money.—104 oboli make 1 Spanish dollar (50*d.* sterling).

Ireland; see Great Britain.

Jamaica; see West Indies.

ITALY.

The measures and weights now adopted throughout Italy are those of the metric system of France; see p. 75.

Money.

	ENGLISH VALUE.
100 centimes make 1 lira.	9·125*d.* sterling.

For former measures, weights, and moneys, see Modena, Naples, Parma, Roman States, Sardinia, Sicily, Tuscany, and Venetian Lombardy.

JAPAN (ASIA).

The long measure of Japan is the inc (6¼ English feet).

Money.

10 rin make 1 sen	½*d.* sterling.
100 sen „ 1 yen	4*s.* 2*d.* „

ISLAND OF JAVA: BATAVIA.

Length.—The ell is 27¾ English inches; the foot is the Rhineland foot (12·357 inches); the ikje (3 ells) is 83¼ inches.

Capacity.—The kanne is about ⅔ of an English gallon.

Weight.—The weights are those of China.

Money.—The old florin of Batavia is valued at 19¾*d.* sterling; the rixdollar 37½*d.*; and the new gulden or florin of the Netherlands is valued at 20*d.* sterling. See Holland.

Kiel; see Germany.

Konigsberg; see Prussia.

Leghorn; see Tuscany.
Leipzic; see Saxony.
Lille; see France.
Lisbon; see Portugal.
Lombardo-Veneto; see Venetian Lombardy.
London; see Great Britain, p. 50.

LUBECK (GERMANY).

Length.

		ENGLISH VALUE.
12 punkte	make 1 linie	0·16 inches.
6 linien	„ 1 zoll	0·95 „
12 zoll	„ 1 fuss	11·45 „ or 0·9542 feet.
2 fuss	„ 1 elle	22·90 „ 1·9084 „

Liquid Capacity.

2 ort	make 1 planke	0·0996 gallons or 0·7968 pints.	
2 planken	„ 1 quartier	0·1992 „	1·5936 „
2 quartier	„ 1 kanne	0·3985 „	3·188 „
2 kannen	„ 1 stübchen	0·797 „	
2 stübchen	„ 1 viertel	1·594 „	
5 viertel	„ 1 anker	7·97 „	
4 anker	„ 1 ohm	31·88 „	
6 ohm	„ 1 fuder	191·28 „	
The eimer is	4 viertel	6·376 „	
The oxhoft is	30 „	47·82 „	

Dry Capacity (Wheat, &c.).

4 fass	make 1 scheffel	0·92 bushels.	
4 scheffel	„ 1 tonne	3·68 „	
3 tonnen	„ 1 drömt	11·04 „	or 1·38 quarters.
8 drömt	„ 1 last	88·32 „	11·04 „

The corresponding measures for oats are $\frac{1}{6}$th larger.

Weight.

4 pfennig	make 1 quentchen	58·4 grains or 0·1336 oz.	
4 quentchen	„ 1 loth	233·7 „	0·5343 „
2 loth	„ 1 unze	467·5 „	1·0686 „
8 unzen	„ 1 mark	3740 „	0·5343 lb.
2 mark	„ 1 pfund	7480 „	1·0686 „

Gold and silver are weighed by the Cologne mark (3609 grains); and apothecaries' weight is the same as Nürnberg.

Money (*Hamburg standard*).

12 pfennige make 1 schilling	1·1*d.* sterling.
16 schillinge „ 1 mark	17·6*d.* „

For the new imperial measures, weights, and moneys, now in use, see Germany, p. 78.

Lucca (Italy); see Tuscany.
Lucerne; see Switzerland.
Lyons; see France.
Madeira (in Atlantic); see Portugal.
Madras; see East Indies.
Madrid; see Spain.
Malaga; see Spain.

MALTA (IN MEDITERRANEAN).

Length.—The foot is 11·17 English inches; the palmo is 10·3 inches; and the canna is 8 palmi or 82·4 inches.

Capacity.

	ENGLISH VALUE.
The caffiso of oil is	4·580 gallons imperial.
„ barile of wine is	9·160 „ „
„ salma of corn is	7·969 bushels.

Weight.

The rottolo of 30 ounces is	1¾ lbs. avoirdupois.
„ cantaro of 100 rottoli is	175 „ „
64 rottoli make	1 cwt.

Money.

20 grani make 1 taro	1·65*d.* sterling
12 tari „ 1 scudo	20*d.* „
2½ scudo = 30 tari „ 1 pezza, Sicilian dollar	50*d.* „

As dollars and doubloons here form the principal circulating medium, it was ordered, in 1845, that the Spanish or South American dollar should pass for 4*s.* 2*d.* or 30 tari,

and the Sicilian dollar for 4*s.* or 28 tari and 16 grani. But the pezza or dollar of Sicily is usually valued at 50*d.* as above stated.

Marseilles; see France.

MAURITIUS (IN INDIAN SEA).

For weights and measures, see Great Britain; and also France ("ancient system").

Money.—100 cents make 1 current dollar (50*d.* sterling).

The Spanish dollar is valued at 4*s.* 4*d.* sterling, and is divided into halves, quarters, eighths, and sixteenths.

In 1843 an order in council established the pound sterling as the money for public accounts, and gave to the coins circulating in the colony the following values:—

Dollars of Spain, Mexico, and South America	4*s.* 2*d.* = 1·04$\frac{1}{8}$	Mauritius dollars.	
East India Company's rupee	1*s.* 10*d.* = 0·45$\frac{3}{8}$	„	„
„ „ „ gold mohur	29*s.* 2*d.* = 7·29$\frac{1}{8}$	„	„
5 francs	3*s.* 10*d.* = 0·96$\frac{21}{25}$	„	„
Napoleon of 20 francs . .	15*s.* 10*d.* = 3·95$\frac{3}{8}$	„	„

To obviate fractions, the population freely pass rupees at two to the Mauritius dollar; which, therefore, represents only 3*s.* 8*d.* instead of 4*s.* Thus British coins are practically excluded, excepting in government transactions, and rupees have become the principal currency.

Subsequent to 1875 the metric system of France has been introduced into the Mauritius and its dependencies.

Primary standards of the metre, litre, and kilogram have recently been issued for that government by the Board of Trade.

MECKLENBURG-SCHWERIN / MECKLENBURG-STRELITZ (GERMANY).

The weights and measures were the same as Hamburg, with the exception of measures of capacity which were those of Lubeck. For metric system now in use, see Germany.

Memel; see Prussia.

MEXICO (NORTH AMERICA).

The weights and measures of Mexico are those of Spain, with some local variations difficult to ascertain and enumerate. See Spain.

Accounts are kept in pesos or dollars of 8 reals, the real being usually valued at 6 pence sterling.

Milan (Italy); see Venetian Lombardy.

Mocha; see Arabia.

MODENA (ITALY).

Length.

The piede, or foot, is 20·592 English inches.

6 piedi make 1 cavezzo (123·55 inches = 10·296 feet = 3·432 yards).

The braccio (2½ Genoa palmi) = 24·52 inches.

Surface.—The biolca, of 72 tavole (288 square cavezzi) = 3392 square yards or 0·7009 acre.

Liquid Capacity.

		ENGLISH VALUE.
2 boccali make	1 fiasco	0·4534 gallons.
20 fiasci „	1 barile	9·1660 „

Dry Capacity.

2 staja make 1 sacco	3·876 bushels or 0·4845 quarter.

Weight.

16 ferlini make	1 oncia	411 grains or 0·0394 oz.
12 oncie „	1 libbra or lira	4932 „ 0·7046 lb

For more recent information see Italy, p. 86.

Montpelier; see France.

MOROCCO (AFRICA).

The cubit or canna	21 inches.
The pic	26 „
The commercial pound	1·190 lb.
The market pound	1·765 „

The principal coins in circulation are Spanish dollars and doubloons.

Moscow; see Russia.
Munich; see Bavaria.
Munster; see Prussia.
Nantes; see France.

NAPLES, THE TWO SICILIES (ITALY).

Length.

	ENGLISH VALUE.
5 minuti make 1 oncïa	0·865 inches.
12 oncie „ 1 palmo	10·382 „ or 0·8652 feet.
8 palmi „ 1 canna	83·055 „ 6·9213 „
The pertica or passo is 7½ palmi	77·865 „ 6·4887 „
The míglio is 7000 palmi	6056 feet or 1·1470 mile.

Surface.

The mòggio is 900 square passi or 50625 square palmi	37898 square feet or 0·8700 acre.

Liquid Capacity (Wine, Spirits, &c.).

60 caratti make 1 barile	9·174 gallons.
12 barili „ 1 botte	110·088 „
2 botti „ 1 carro	220·176 „

Liquid Capacity (Oil).

6 misurelle make 1 quarto	0·1392 gallons.
16 quarti „ 1 stájo	2·228 „
16 staja „ 1 salma	35·647 „

The stájo is also divided into 20 pignate.

Dry Capacity.

24 misure make 1 tomolo	1·407 bushels.
36 tomoli „ 1 carro	50·660 „ or 6·332 quarters.

Weight (*Troy and Apothecaries'*).

20 accini make 1 trapeso or scrupolo	13¾ grains.
3 scrupoli „ 1 dramma	41¼ „
10 dramme „ 1 oncia	412½ „ or 0·8594 oz. troy
12 oncie „ 1 libbra	4950 „ 0·8594 lb. „
The rotolo grosso is 33⅓ oncie	1·9643 lb. avoirdupois.
The rotolo piccolo is 18 oncie	1·0607 „ „

Money.

10 grani make 1 carlino	4*d.* sterling.
2 carlini „ 1 taro	8*d.* „
5 tari / 100 grani „ 1 ducat	39¾*d.* „
The gold oncetta (1818)	10*s.* 3*d.* „

For more recent information, see Italy, p. 86.

Netherlands; see Holland.

Neuchâtel or Neufchâtel; see Switzerland.

New South Wales; see Great Britain.

New York; see United States.

Newfoundland; see Great Britain.

Nice (Italy); see Sardinia.

North America; see United States.

Norway; see Sweden and Norway.

Nova Scotia; see British Possessions in North America.

NÜRNBERG, OR NUREMBERG (BAVARIA).

The apothecaries' weight of Nürnberg is used for medicines throughout Germany. Its pfund is ¾ of the old Nürnberg money pound, or 1½ old Nürnberg mark, and is subdivided thus :—

20 gran make 1 scrupel	19·2 grains.
3 scrupel „ 1 drachme	57·5 „
8 drachmen „ 1 unze	460 „ or 0·9583 oz. troy.
12 unzen „ 1 pfund	5520 „ 11½ „ „

For further particulars of the weights, measures, and money of Nürnberg, see Bavaria.

Odessa; see Russia.

Oporto; see Portugal.

Ostend; see Belgium.

OTTOMAN ASIA: ALEPPO, SMYRNA, &c.

The Turkish pic (26·8 inches) is used for measures of length, and the oke for weight. At Damascus the pic is 23 inches.

Weight.

6 okes make 1 batman	16·974 lbs.
7½ batman „ 1 cantaro	127·305 „

Ottoman Empire; see Turkey.

Padua (Italy); see Venetian Lombardy.

Palermo (Sicily); see Sicily.

Paris; see France.

PARMA (ITALY).

Length.

	ENGLISH VALUE.
12 atomi make 1 punto	0·15 inches.
12 punti „ 1 oncia	1·78 „
12 oncie „ 1 braccio di legno	21·34 „ or 1·7783 feet.
6 braccia „ 1 pertica	128·04 „ 10·6700 „
The pié or foot =	22·428 „ 1·8690 „

Surface.—The biolca, of 6 stari (288 square pertica) = 3643 square yards or 0·7527 acre.

Liquid Capacity.—See Milan.

Dry Capacity.

8 quartaròli make 1 mina	0·7066 bushels.
2 mine „ 1 stájo	1·4132 „

Weight.

24 grani make 1 denaro	17·5 grains.	
24 denari „ 1 oncia	419·8 „	
12 oncie „ 1 libbra	5038 „	or 0·7197 lb.
25 libbre „ 1 rubbio	17·99 lbs.	

For gold and silver weight, see Venetian Lombardy.

Money.

The 5 lire silver piece (1815)	3*s.* 11*d.* sterling.
„ 20 „ „ „	15*s.* 10*d.* „
The gold sequin (zecchino)	9*s.* 5*d.* „

For more recent information see Italy, p. 86.

PERSIA (ASIA).

Length.

The royal guerze, or monkelser, is 37½ English inches.
The common guerze is ⅔ the royal, or 25 „ „
The arish is 38·27 English inches.

Capacity.

	ENGLISH VALUE.
4 sextarios make 1 chenicas	80·26 cubic inches.
2 chenicas „ 1 capichas	160·52 „ „
25 capichas „ 1 artaba	4013 „ „ or 1·809 bushels.

Weight.

2 mascals make 1 dirhem	0·0423 lbs. or 0·0211 lbs.
50 dirhems „ 1 rattel	2·1136 „ 1·0563 „
6 rattels „ 1 batman	12·6816 „ 6·3408 „

Both sorts of weights are used with these divisions.
The batman of Shirez is 12·6816 lbs. avoirdupois.
„ „ Tauris „ 6·3408 „ „
The dirhem used for weighing gold and silver = 150 grains troy.

Money.

5 dinars simple make 1 kasbequis	0·216*d.* sterling.
2 kasbequis „ 1 dinars-bisti	0·432*d.* „
5 dinars-bisti „ 1 shatree	2·16*d.* „
2 shatrees „ 1 mamoodi	4·32*d.* „
2 mamoodi „ 1 abassi	8·64*d.* „
50 abassi „ 1 toman	1*l.* 16*s.* „
The silver rupee	1*s.* 11*d.* „
„ gold „	1*l.* 9*s.* 2*d.* „

The above dinar and toman are imaginary moneys of account, not represented by coins. The Persian gold toman is worth about 11*s.* sterling; and the silver rupee about 18*d.*

Petersburg; see Russia.
Philadelphia; see United States.
Piedmont; see Sardinia.
Pondicherry (Asia); see France.

PORTUGAL.

Length.

			ENGLISH VALUE.
12 pontos	make 1 linha or line	0·090 inches.	
12 linhas	„ 1 pollegada, thumb, or inch	1·082 „	
8 pollegadas	„ 1 palmo or span	8·656 „	or 0·7214 feet.
5 palmos	„ 1 vara or yard	43·28 „	3·6067 „
2 varas	„ 1 braça or fathom	86·56 „	7·214 „

The grao (of barley, in width) is 2 linhas	0·1803 inches	
„ dedo or finger „ 8 linhas	0·7213 „	
„ covada or cubit „ 3 palmos	25·968 „	or 2·164 feet

The commercial covada measures 27 inches.

The Portuguese mile is 1·2786 miles English.

To reduce Portuguese palmos to English feet. Take $\frac{5}{7}$ths and increase the same by its $\frac{1}{100}$th part.

Surface.—The square palmo = 74·926 square inches or 0·5203 square feet.

The geira is 4840 square vara = 62959 square feet or 1·4453 acres.

Liquid Capacity.

		LISBON.	OPORTO.	
4 quartilhos make	1 canada	0·3034	0·46	gallons.
6 canadas „	1 pote, cantaro, or alqueire	1·8202	2·76	gallons.
2 potes „	1 almŭde	3·6405	5·52	gallons.

The almŭde of { Lisbon = 3·6405 / Oporto = 5·5200 } imperial gallons.

Dry Capacity.

			ENGLISH VALUE.		
			LISBON.	OPORTO.	
8 outavas	make 1 alqueire		0·3720	0·4696	
4 alqueires	„ 1 fanga		1·4878	1·8782	bushels.
15 fangas	„ 1 moio		22·317	28·173	

The fanga of Lisbon = 1·4878, Oporto = 1·8782 } imperial bushel.

Timber is measured in cubic polegadas; masonry in cubic palmas; earthwork in cubic braças.

A cubic palmo = 648·56 cubic inches or 0·37532 cubic foot.

Weight.

24 graos	make 1 scropulo	18·45 grains.	
3 scropulos	„ 1 outava	55·34	„
8 outavas	„ 1 onça	442·69	„
16 onça	„ 1 arratel or pound	7083	„ or 1·01186 lb.
32 arratels	„ 1 arroba	32·3795 lbs.	
4 arrobas	„ 1 quintal	129·518	„

Gold and silver are weighed by the marco of 8 onças; and medicines are weighed by a libra of 12 onças = $\frac{3}{4}$ arratel.

In Portugal the measures and weights are now those of the metric system; see France, p. 75.

Money.

1 vintem	= 20 reas	1·1 pence sterling.	
1 testoon	= 100 „	5·6	„ „
1 patàca	= 320 „	17·9	„ „
1 crusàdo	= 400 „	22·4	„ „
1 sello or new crusàdo	= 480 „	26·9	„ „
Silver crown, 1 milrea	= 1000 „	56·0	„ „
„ Brazillian dollar	= 1920 „	107·5	„ „
Gold crown, 5 milreas	= 5000 „	1*l.* 3*s.* 4*d.*	„
Moeda of 4000 gold	= 9000 „	2*l.* 2*s.* 0*d.*	„
„ 6400 „	=16000 „	3*l.* 14*s.* 8*d.*	„
Milrea of Madeira		50*d.*	„
„ „ Azores		41·6*d.*	„

The rei is an imaginary coin of reckoning, and the milrea =1000 reis is usually written 1$000; also 1000 milreis, or one million of reis, is called a conto of reis, and written 1:000$000.

In 1834, foreign moneys were ordered to be received as a legal tender at the rate of 4120 reis for an English sovereign, and 870 reis for a Spanish or Mexican dollar.

Prague; see Bohemia.

Prince Edward's Island; see British Possessions in North America.

Presburg; see Vienna.

PRUSSIA.

Length.

			ENGLISH VALUE.
12 scrupel	make 1 linie		0·086 inches.
12 linien	„ 1 zoll		1·03 „
12 zoll	„ 1 fuss Rhein-fuss		12·357 „ or 1·0298 feet.
12 Rhein-fuss	„ 1 ruthe		12·357 feet or 4·119 yards.
2000 ruthen	„ 1 post-meile		8238 yards or 4·6807 miles.
The elle is 25½ zoll or 2⅛ Rhein-fuss			26·258 inches = 2·1882 feet or 0 7294 yard.

Surface.

The morgen is 180 square ruthen	3054 square yards or 0·6310 acre.

Liquid Capacity.

2 össel	make 1 quartier	70 cubic inches or 0·252 gallons.		
30 quartier	„ 1 anker	2096	„ „ 7·559	„
2 anker	„ 1 eimer	4192	„ „ 15·118	„
2 eimer	„ 1 ohm	8384	„ „ 30·237	„
6 ohm	„ 1 fuder	50304	„ „ 181·4	„

Dry Capacity.

4 mässchen	make 1 metze	209·6 cubic inches or 0·0945 bushels.		
4 metzen	„ 1 viertel	838·5	„ „ 0·3780	„
4 viertel	„ 1 scheffel	3354	„ „ 1·5121	„
12 scheffel	„ 1 malter	18·145 bushels or 2·2681 quarters.		
6 malter	„ 1 last	108·870	„ 1·3609 last.	
The wispel is 18 scheffel		27·2175	„ 3·4022 quarters.	

Weight.

4 quentchen	make 1 loth	225·6 grains or 0 5156 oz.		
2 loth	„ 1 unze	451·1	„ 1·0311	„
8 unzen	„ 1 mark (Cologne)	3609	„ 0 5156 lbs.	
2 mark	„ 1 pfund	7218	„ 1·0311	„

The pfund is $\frac{1}{66}$ of a Rhineland cubic foot of distilled water, weighed, and reduced to a vacuum, at the temperature of 15° Reaumur or 65¾° Fahrenheit.

			ENGLISH VALUE.
The liespfund	is	16½ pfund	17·014 lbs.
The centner = 5 stein	„	110 „	113·426 „
The schiffpfund = 3 centner	„	330 „	340·277 „

For weighing Gold and Silver.

233 grains make 1 Cologne mark = 3609 English grains.

Apothecaries' Weight.

20 gran	make 1 scrupel	18·8 grains	or	0·039	oz. troy.
3 scrupel	„ 1 drachme	56·4	„	0·117	„ „
8 drachme	„ 1 unze	451·1	„	0·940	„ „
12 unzen	„ 1 pfund	5413·5	„	11·278	„ „

Money.

12 pfennige	make 1 groschen	1⅛*d.* sterling.
30 silver groschen	„ 1 rix dollar or thaler	2*s.* 10¾*d.* „

The dollar used formerly to be divided into 24 good groschen.

The Cologne mark weight of *fine* silver is coined into 14 Prussian dollars, from which the above sterling value is calculated.

The gold ducat is estimated at 9*s.* 3*d.*, and the Frederick at 16*s.* 4*d.* sterling.

For the new imperial measures, weights, and moneys, now in use, see Germany, p. 78.

Quebec ; see Great Britain.
Rangoon ; see Birmah.
Revel ; see Russia.
Riga ; see Russia.
Rio de Janeiro ; see Brazil.
Rochelle ; see France.

ROMAN STATES (ITALY).

1. ROME.

Length (Commercial).

		ENGLISH VALUE.
The pié or foot measures		11·592 inches or 0·966 feet.
The palmo	„	8·796 „ 0·733 „
The canne	„	78·4 „ 6·533 „
The braccio	„	30·732 „ 2·561 „

For Cloth, &c.

The palmo	measures	8 347 inches.
The fathom of 3 palmi	„	25·041 „
The fathom of 4 palmi	„	33·388 „

Length (Architects, &c.).

10 decimi	make	1 oncia	0·73 inches.	
12 oncie	„	1 palmo	8·79 „	or 0·7325 feet.
10 palmi	„	1 canna	87·9 „	7·3250 „
The pié	is	16 oncie	11·72 „	0·9767 „
The catèna 10 stajoli	„	57½ palmi	42·119 feet.	
The ancient foot	=		11·62 inches.	

Liquid Capacity.

4 quartucci	make	1 foglietta	0·1003 gallons.
4 foglietti	„	1 boccale	0·4012 „
32 boccali	„	1 barile	12·84 „
16 barili	„	1 botte	205·44 „

Dry Capacity.

4 quartucci	make	1 scorzo	0·3682 bushels.
1⅔ scorzi	„	1 starello	0·5063 „
4 starelli	„	1 quarta	2·0251 „
4 quarte	„	1 rubbio	8·1004 „
The stairo	is	½ quarta	0·6750 „

Weight.

24 grani	make	1 denaro	18·2 grains.	
24 denari	„	1 oncia	436·2 „	or 0·9970 oz.
12 oncie	„	1 libbra	5234 „	„ 0·7477 lb.
The ancient libbra			4966	„ 0 7094 „

Money.

	ENGLISH VALUE.
10 bajocchi make 1 paolo	5*d.* sterling.
10 paoli „ 1 Roman scudo (silver crown)	50½*d.* „
The 10 scudi gold piece =	42*s.* 8*d.* „
The gold sequin =	9*s.* 2*d.* „
„ „ pistole =	13*s.* 6*d.* „

For more recent information see Italy, p. 86.

2. BOLOGNA.

Liquid Capacity.

4 fogliette make 1 boccale	0·288 gallons.
15 boccali „ 1 quarterone	4·32 „
4 quarteroni „ 1 corba	17·28 „

Dry Capacity.

4 quarticini make 1 quarterone	0·27 bushels.
4 quarteroni „ 1 stâjo	1·08 „
2 staja „ 1 corba	2·16 „

The capacity of the corba is the same in both liquid and dry measure.

Weight.

4 grani make 1 carato	2·9 grains.
10 carati „ 1 ferlino	29·1 „
2 ferlini „ 1 ottavo	58·2 „
8 ottavi „ 1 oncia	465·5 „ or 1·064 oz.
12 oncie „ 1 libbra	5586 „ 0·798 lb.

For more recent information see Italy.

3. ANCONA.

The foot measures	15·384 inches or 1·282 feet.
„ braccio or ell „	25⅓ „ 2⅛ „
„ soma „	18·9 gallons.
„ rubbio „	7·73 bushels.
„ commercial libbra weighs	5094 grains or 0·7277 lb.

For more recent information see Italy, p. 86.

Rotterdam; see Holland.

Rouen; see France.

RUSSIA.

Length.

		ENGLISH VALUE.
16 verschoks make	1 archine	28 inches.
3 archines „	1 sachine	7 feet.
500 sachines „	1 verst or werst	3500 „ or 0·6629 miles.
The Lithuania meile is 28530 Rhein-fuss		9793 yards or 5·5641 „

Liquid Capacity.

100 tscharkeys make	1 vedro	750 cubic inches or 2·7049 gallons.
3 vedros „	1 anker	2250 „ „ 8·1147 „
40 vedros „	1 sarokowaja	324·588 „

Dry Capacity.

2 garnetz make	1 tschetwerka	400 cubic inches or 0·1603 oushels.
4 tschetwerkas „	1 tschetwerik	1600 „ „ 0·7213 „
2 tschetweriks „	1 pajak	3200 „ „ 1·4426 „
2 pajaks „	1 osmin	6400 „ „ 2·8852 „
2 osmins „	tschetwert	12800 „ „ 5·7704 „

Weight.

96 doli make	1 zolotnic	65·8 grains or 0·1504 oz.
3 zolotnics „	1 loth	197·4 „ 0·4513 „
8 zolotnics „	1 lana	526·5 „ 1·2035 „
12 lanas (32 loths) „	1 funt or pound	6318·5 „ 0·90264 lbs.
40 funts „	1 pud	36·1056 lbs.
10 puds „	1 berkowitz	361·056 „
3 berkowitz „	1 packen	1083·168 „

Money.

100 copecs make 1 silver ruble (37½*d.* sterling).

The gold ducat (1796)	9*s.* 5*d.* sterling.
„ „ imperial (1801)	32*s.* 2*d.* „

The paper ruble, 2*s.* 6*d.* to 2*s.* 9*d.* sterling.

St. Domingo (Hayti); see West Indies.

St. Gall, or St. Gallen; see Switzerland.

St. Petersburg; see Russia.

SARDINIA (ITALY).

1. GENOA.

Length.

			ENGLISH VALUE.
12 atomi	make 1 punto	0·140 inches.	
12 punti	„ 1 oncia	1·686 „	
12 oncie	„ 1 piede liprando	20·228 „	or 1·6857 foot.
8 oncie	„ 1 piede manuale	14·712 „	1·2260 „
5⅓ oncie	„ 1 palmo	9·808 „	0·8173 „
2⅔ palmi	„ 1 braccio	22·885 „	1·9071 „
9 palmi nearly	„ 1 canna	87·60 „	7·30 „

Liquid Capacity.

90 amole or 50 pinte	make 1 barile	16·337 gallons.
2 barili	„ 1 mezzaruòla	32·674 „

Dry Capacity.

12 gombette	make 1 quarto	0·415 bushels.
8 quarti	„ 1 mina	3·321 „

Weight.

24 grani	make 1 denaro	17 grains.	
24 denari	„ 1 oncia	407·7 „	or 0·8494 oz. troy.
12 oncie	„ 1 libbra	4892 „	0·8494 lb. „
18 oncie	„ 1 rottolo	7338 „	1·0483 „ avoirdupois.

Money.—100 centesimi make 1 lira nuova (9·12*d.* sterling).

Also see Italy, p. 86.

2. PIEDMONT : TURIN.

Length.

12 atomi	make 1 punto	0·140 inches.
12 punti	„ 1 oncia	1·686 „
12 oncie	„ 1 piede liprando	20·228 „
6 piede liprando	„ 1 trabucco	10·114 feet.
2 trabucci	„ 1 pertica	20·228 „
The raso or ell is 14 oncie		23 60 inches.
The míglio is 4333⅓ piedi liprando		7305 feet or 1·3835 miles.

Surface.—The giornata is 100 square pertica or 14400 square piedi liprando = 40917 square feet or 0·9393 acre.

Liquid Capacity.

			ENGLISH VALUE.
2 quartini	make	1 boccale	0·1722 gallons.
2 boccali	,,	1 pinta	0·3444 ,,
6 pinte	,,	1 rubbio	2·0664 ,,
6 rubbi	,,	1 brenta	12·3984 ,,
10 brente	,,	1 carro	123·984 ,,

Dry Capacity.

20 cucchiari	make	1 copello	0·066 bushels.
4 copelli	,,	1 quartière	0·264 ,,
2 quartieri	,,	1 mina	0·527 ,,
2 mine	,,	1 stájo	1·054 ,,
3 staja	,,	1 sacco	3·162 ,,

Weight.

24 granotini	make	1 grano	0·8 grains.	
24 grani	,,	1 denaro	19·8 ,,	
3 denari	,,	1 ottavo	59·3 ,,	
8 ottavi	,,	1 oncia	474·4 ,,	or 0·9883 oz troy.
12 oncie	,,	1 libbra	5693 ,,	0·9883 lb. ,,
The marco	is	8 oncie	3795 ,,	0·6589 ,, ,,

For gold and silver the carato is 4 grani.
The apothecaries' pound is $1\frac{1}{4}$ marco.
For more recent information see Italy, p. 86.

Savoy; see Sardinia.

SAXONY (GERMANY): DRESDEN AND LEIPZIC.

Length.

10 linien	make	1 zoll	0·929 inches.
12 zoll	,,	1 fuss	11·148 ,, or 0·9290 foot.
2 fuss	,,	1 elle	1·858 feet 0·6193 yards.
8 ellen	,,	1 ruthe	14·864 ,, 4·9547 ,,
The post-meile is 24000 fuss			7432 yards or 4·2227 miles.
Leipzic (architects') fuss			11·13 inches or 0·9275 foot.

Liquid Capacity.

		ENGLISH VALUE.
4 quartier	make 1 nössel	0·1325 gallons.
2 nössel	„ 1 kanne	0·2650 „
63 kannen	„ 1 eimer	16·6942 „
2 eimer	„ 1 ohm	33·3883 „
6 ohm	„ 1 fuder	200·330 „
The anker	is 54 kannen	14·309 „
„ oxhoft	„ 3 eimer	50·083 „
„ fass	„ 5 „	83·471 „

The Dresden liquid measures are $\frac{1}{9}$th less.

Dry Capacity.

4 mässchen	make 1 metze	0·1786 bushels.	
4 metzen	„ 1 viertel	0·7146 „	
4 viertel	„ 1 scheffel	2·8583 „	or 0·3573 quarters
12 scheffel	„ 1 malter	34·3 „	4·2875 „
2 malter	„ 1 wispel	68·6 „	8·5750 „

Weight.

15 gran	make 1 pfennig	14·1 grains.	
4 pfennig	„ 1 quentlein	56·4 „	or 0·1289 oz.
4 quentlein	„ 1 loth	225·5 „	0·5154 „
2 loth	„ 1 unze	451 „	1·0309 „
8 unzen	„ 1 mark	3608 „	0·5154 lb.
2 mark	„ 1 pfund	7216 „	1·0309 „

Money (*same standard as Prussia*).

12 pfennige	make 1 neu-groschen	$1\frac{1}{6}d.$ sterling.
30 neu-groschen	„ 1 dollar or thaler	$34\frac{3}{4}d.$ „
The gold ducat		9*s.* 5*d.* „

For the new imperial measures, weights, and moneys, now in use, see Germany, p. 78.

Seville; see Spain.

SIAM (ASIA).

Length

12 nins make 1 kub	10 inches
2 kubs „ 1 sok	20 „
2 soks „ 1 ken	40 „
2 kens „ 1 wa	80 „
The roënong of 2000 vouhs =	12612 feet or 2·3886 miles

Liquid Capacity.

100 nins make 1 thanan or cocoa-nut-shell	57·87 cubic inches.

Dry Capacity.

	ENGLISH VALUE.
2000 nin make 1 thangsat or bucket	0·52178 bushel = 1157·41 cubic inches.

Weight.

4 bats or ticals make 1 tael	936·25 grains or 0·13375 lbs.
20 taels make 1 chang or catty	2·675 lbs.
50 changs or catties make 1 hap or pecul	133·75 „

Money.—The coins are gold ticals, which pass for 10 silver ticals, each of the latter being worth about 26*d.*

Siberia; see Russia.

SICILY.

Length.

The palmo is 9·53 inches.
The canna (8 palmi) is 76·25 inches.
Archimedes foot „ 8·76 inches.

Capacity.

The salma of Messina is 19·226 gallons.
„ „ Syracuse is 16·823 „
„ „ grossa (dry measure) is 9·472 bushels.
„ „ generale „ „ 7·630 „

Weight.

The libbra of 12 oncie is 0·7 lb.
„ rottolo grosso of 33 oncie „ 1·925 lb.
„ „ sottile of 30 oncie „ 1·75 „

Money.

20 grani make 1 taro	4·1*d.* sterling.
12 tari „ 1 scudo	4*s.* 1·4*d.* „
$2\frac{1}{2}$ scudi = 30 tari „ 1 oncia	10*s.* $3\frac{1}{2}$*d.* „

For more recent information see Italy, p. 86.

Smyrna (Asia); see Turkey.

SPAIN: MADRID AND CASTILE.

Length.

		ENGLISH VALUE.
12 puntos	make 1 linea	0·077 inches.
12 lineas	„ 1 pulgada	0·927 „
6 pulgadas	„ 1 sesma	5·564 „
2 sesmas	„ 1 pie (foot)	11·128 „ or 0·9273 feet.
3 pie	„ 1 vara	33·384 „ 2·782 „
4 varas	„ 1 estadal	133·536 „ 11·128 „
The dedo	is 9 lineas	0·6955 „
The palmo	„ 12 dedos	8·346 „
The legua	„ 8000 vara	22256 feet or 4·2152 miles.

Liquid Capacity (Wine, &c.).

4 copas	make 1 quartillo	0·1105 gallons.
4 quartillos	„ 1 azumbre	0·4422 „
8 azumbres	„ 1 arrōba or cantaro	3·5380 „

The arrōba for oil contains 2·78 English gallons and is divided into 4 quartillos or 100 panillas. The standards of the arrōba are 34 libras of water and 25 libras of oil.

Dry Capacity.

4 ochavillos	make 1 racion	0·0081 bushels.
4 raciones	„ 1 quartillo	0·0323 „
2 quartillos	„ 1 medio	0·0646 „
2 medios	„ 1 almude	0·1292 „
12 almudes	„ 1 fanega	1·5503 „
12 fanegas	„ 1 cahiz	18·6034 „ or 2·3254 quarters.

Weight.

12 granos	make 1 tomin	9·2 grains.	
3 tomines	„ 1 adarme	27·7 „	
2 adarmes	„ 1 ochava or dracma	55·5 „	
8 ochavas	„ 1 onza	443·8 „	or 0·0634 lb.
8 onzas	„ 1 marco	3550·5 „	0·5072 „
2 marcos	„ 1 libra	7101 „	1·0144 „

Money.

20 reals vellon or 10⅔ reals of plate } make { 1 duro, piastre, or hard dollar } (50*d.* sterling).

The reals are each of them divided into 34 maravedises.

The legal money of Spain is founded on the reals vellon which are now more commonly divided into 10 decimas or 100 centenas.

The Spanish dollar is by law also divided into 100 cents.

The gold pistole is estimated at 15*s.* 11*d.* sterling.
,, ,, doubloon ,, ,, 65*s.* 10*d.* ,,
The silver peseta is one-fifth of the piastre.

The metric system of measures, weights, and decimal system of moneys is now adopted. See France, p. 75.

Stockholm; see Sweden and Norway.

Strasbourg; see Germany.

SWEDEN AND NORWAY.

Length.

		ENGLISH VALUE.
12 linies	make 1 tum	0·9742 inches.
12 tums	,, 1 fot	11·6904 ,, or 0·9742 foot.
2 fots	,, 1 aln	23·3808 ,, 1·9484 ,,
3 alns	,, 1 famn	5·8452 feet.
The stäng is	8 aln	15·5872 ,,
The mil	,, 6000 famn	11690 yards or 6·6423 miles.

The fot is now decimally divided.

Liquid Capacity.

4 jungfrus	make 1 qwarter	0·5756 pints.
4 qwarters	,, 1 stop	2·3024 ,,
2 stops	,, 1 kanna	4·6048 ,, or 0·5756 gallon.
48 kannas	,, 1 tunna	27·6288 gallons.

Dry Capacity.

4 orts	make 1 qwarter	0·0090 bushels.
4 qwarters	,, 1 stop	0·0360 ,,
2 stops	,, 1 kanna	0·0720 ,,
7 kannas	,, 1 fjerding	0·5038 ,,
4 fjerdings	,, 1 spann	2·0150 ,,
2 spanns	,, 1 tunna of 32 kappe	4·0300 ,, or 0·50375 quarter.

Weight (*Commercial*).

The smallest denomination of weight in Sweden is the as = 0·7418 English grain.

	ENGLISH VALUE.
4 qwintin make 1 lod	205·1 grains.
2 lods „ 1 untz	410·2 „
16 untzs „ 1 skälpund = 8348 as	6563·2 „ or 0·9376 lb.
The lispund is 20 skälpunds	18·752 lbs.
The skeppund is 400 skälpunds	375·040 „

Weight (*Gold and Silver*).

4 qwintin make 1 lod	203·2 grains or 0·4234 oz. troy.
2 lods „ 1 untz	406·5 „ 0·8469 „ „
8 untzs „ 1 mark = 4384 as	3252 „ 6·7750 „ „

Apothecaries' Weight.

20 grains make 1 scrupel	19·1 grains or 0·0398 oz. troy.
3 scrupels „ 1 drachma	57·3 „ 0·1194 „ „
8 drachmas „ 1 untz	458·4 „ 0·9550 „ „
12 untzs „ 1 skalpund = 7416 as	5501 „ 11·4604 „ „

Money.

12 runstycken make 1 skilling	1·1*d.* sterling.
48 skillings „ 1 riksdaler (silver specie)	53*d.* „
The gold ducat	9*s.* 2*d.* „

The riksdaler banco is only $\frac{2}{3}$ the above value.

In Norway the riksdaler is divided into 120 skillings.

The measures, weights, and currency of Sweden and Norway are since 1875 established on the decimal system. The monetary basis is now the following:—

Money.

100 öre make 1 riksdaler	1*s.* 1·3*d.* sterling.

The measures and weights, now in use, are those of the metric system of France. See p. 75.

SWITZERLAND.

1. BERNE.

Length.

		ENGLISH VALUE.
12 secundes make 1 linie		0·08 inches.
12 linien „ 1 zoll		0·96 „
12 zoll „ 1 fuss		11·54 „ or 0·9617 feet.
10 fuss „ 1 ruthe		115·40 „ 9·6167 „
The ell	=	21·40 „ 1·7833 „
The Swiss meile is 26666⅔ fuss	=	8548 yards or 4·8563 miles.

Surface.—The juchart or feld acker, is 400 square ruthen = 4110 square yards or 0·8492 acre.

Liquid Capacity.

2 bechers make 1 vierteli		0·0919 gallons.
4 vierteli „ 1 mass		0·3676 „
25 mass „ 1 eimer		9·19 „
4 eimer „ 1 saum		36·76 „
6 saum „ 1 landfass		220·56 „

Dry Capacity.

2 sechszehnerli make 1 achterli		0·0482 bushels.
2 achterli „ 1 immi		0·0964 „
2 immi „ 1 mässli		0·1927 „
2 mässli „ 1 mäss		0·3854 „
12 mäss „ 1 mütt		4·6250 „

Weight (Commercial).

4 pfennig make 1 quent		63 grains.
4 quent „ 1 loth		251·9 „
2 loth „ 1 unze		503·7 „ or 1·1514 oz.
16 unzen „ 1 pfund		8060 „ 1·1514 lb.

Weight (Gold and Silver).

4 pfennig make 1 quent		59·5 grains.
4 quent „ 1 loth		238·1 „ or 0·4961 oz. troy.
2 loth „ 1 unze		476·3 „ 0·9923 „ „
8 unzen „ 1 marc		3810·3 „ 7·9381 „ „
2 marc „ 1 pfund		7620·6 „ 15·8762 „ „

Apothecaries' Weight.

		ENGLISH VALUE.
20 gran	make 1 scrupel	19·05 grains.
3 scrupel	,, 1 drachma	57·15 ,,
8 drachmen	,, 1 unze	457·2 ,, or 0·9525 oz. troy.
12 unzen	,, 1 pfund	5486·4 ,, 11·430 ,, ,,

Money.

The silver franc (1803)	1*s.* 2*d.* sterling.
,, gold ducat	9*s.* 2*d.* ,,
,, ,, pistole	18*s.* 10*d.* ,,

Since 1873 the legal system of measures, weights, and moneys have been uniformly the same as those of France. See p. 75.

2. LUCERNE.

Length.—The elle is 2 schuh (or Rhein-fuss) = 24·714 inches, or 2·0595 feet.

Liquid Capacity.

10 primas make 1 schoppen	0·0951 gallons.
4 schoppen ,, 1 mass	0·3803 ,,
100 mass ,, 1 saum	38·035 ,,
The ohm is 30 mass	11·410 ,,

Dry Capacity.

10 primas make 1 becher	0·0598 bushels.
16 primas ,, 1 immi	0·0956 ,,
10 immi ,, 1 viertel	0·9561 ,,
4 viertel ,, 1 mütt	3·8245 ,,
4 mütt ,, 1 malter	15·2980 ,,

Weight.

4 quentchen make 1 loth	226 grains or 0·5167 oz.
36 loth ,, 1 pfund	8138 ,, 1·1626 lb.

The French metric system of measures and weights has been adopted since 1873; see p. 75.

3. ZURICH.

Length.

12 linien make 1 zoll		0·984 inches.
12 zoll ,, 1 fuss		11·81 ,, or 0·9842 foot.
(Builders) ,,		11·86 ,, 0·9883 ,,
The ell	=	23·64 ,, 1·9700 ,,

Liquid Capacity.

		ENGLISH VALUE.
2 stotzen	make 1 quärtli	0·1807 gallons.
2 quärtli	„ 1 mass	0·3614 „
15 mass	„ 1 viertel	5·421 „
4 viertel	„ 1 eimer	21·684 „
The kopt is 2 mass		0·7228 „

The land-mass measures are $\frac{1}{9}$th greater.

Dry Capacity.

2¼ immi	make 1 mässli	0·0355 bushels.
4 mässli	„ 1 vierling	0·1422 „
4 vierling	„ 1 viertel	0·5688 „
4 viertel	„ 1 mütt	2·275 „
4 mütt	„ 1 malter	9·10 „

Weight.

12 quenten	make 1 loth	226 grains or 0·5167 oz.
2 loth	„ 1 unze	452 „ 1·0334 „
18 unzen	„ 1 pfund	8138 „ 1·1626 lb.

Money.

The silver crown (1781)	3*s.* 8*d.* sterling.
„ gold ducat	6*s.* 4*d.* „

Since 1873 the measures, weights, and moneys have been the same as those of France ; see page 75.

4. GENEVA.

Length.

The foot	=	23·028 inches or 1·9190 feet.
The ell	=	45·04 „ 3·7533 „

Liquid Capacity.

2 pots	make 1 quarteron	0·415 gallons.
24 quarterons	„ 1 setter	9·954 „
12 setters	„ 1 char	119·448 „

Dry Capacity.—The coupe (or sack) = 2·135 bushels.

Weight.

24 grains	make 1 dernier	19·7 grains.
24 dernier	„ 1 unze	472·2 „ or 1·0794 oz.
18 unzen	„ 1 pfund	8500 „ 1·2143 lb.

Money (*same as France*).—100 cents make 1 lira nuova (franc) (9½*d.* sterling).

Since 1873 the measures and weights have been those of the metric system of France; see p. 75.

5. BASLE OR BÂLE.

Length.

		ENGLISH VALUE.
The foot	=	11·74 inches or 0·9783 feet.
The aune (large ell)		46·4 „ 3·8667 „
The brasse (small ell)		21·4 „ 1·7833 „

Liquid Capacity.

32 pott make 1 ohm		11 gallons.
3 ohm „ 1 saum		33 „

Dry Capacity.

2 becher make 1 köpflein		⅛ bushel.
32 köpflein „ 1 coupe or sack		3⅝ bushels.

Weight.

72 grains make 1 gros		59·4 grains.
8 gros „ 1 unze		475 „ or 1·0857 oz.
16 unzen „ 1 pfund		7600 „ 1·0857 lb.

Money.

100 raps make 1 Swiss frank		13½*d.* sterling.
The silver crown		3*s.* 6*d.* „

Since 1873 the measures, weights, and moneys have been the same as those of France; see p. 75.

6. ST. GALLEN.

Length.

The ell for cloth	=	24·2 inches.
„ „ silks	=	31·6 „

Liquid Capacity.—The eimer (containing 32 mass)=11 gallons.

Dry Capacity.—The mütt (containing 4 viertel) = 2·1 bushels.

Weight.

The heavy pound	=	9016 grains or 1·288 lb.
The light „	=	7175 „ 1·025 „

Money.—60 kreuzers make 1 florin or guilder (20¼*d.* sterling).

Since 1873 the measures, weights, and moneys have been the same as those of France ; see p. 75.

7. NEUFCHATEL.

		ENGLISH VALUE.
The foot	=	11·81 inches.
The ell	=	43·80 ,,

The French metric system is now adopted throughout Switzerland.

Toulon ; see France.

Trieste ; see Austria.

TRIPOLI (BARBARY).

Length.

The Turkish dreah or pik = 3 palmi, is 26·42 English inches.
The arbi dreah or lesser pic is 19·03 ,, ,,

Liquid Capacity.—The barile=24 bozze, is 3956 cubic inches or 14·267 imperial gallons.

Dry Capacity.

2 nufs-orbah make 1 orbah	409·4 cubic in. or 0·1846 bushels.	
4 orbahs ,, 1 temen	1637·7 ,, ,,	0·7383 ,,
4 temen ,, 1 ueba	6551 ,, ,,	2·9533 ,,

Weight.

16 kharoubas make 1 dram	48 grains.	
10 drams ,, 1 okie (oz.)	480 ,,	or 1 oz. troy.
16 okies ,, 1 rottol	7680 ,,	1⅓ lb. ,,
100 rottols ,, 1 cantar	109⅝ lb. avoird.	or 133⅓ lbs. troy.

The metrical (for gold and silver) is 73·6 grains.

Money.

40 paras make 1 piastre	2½*d.*
20 piastres ,, 1 mahhub	4*s.* 2*d.*

Turin ; see Sardinia.

TURKEY.

Length.—The pic or pike is 26·8 inches.

Liquid Capacity.

The almud is 319·4 cubic inches or 1·152 imperial gallon.
The almud of oil should weigh 8 okes or 22⅝ lbs. avoirdupois.

Dry Capacity.

The killow contains 2023 cubic inches or 0·912 bushel.
The fortin is 4 killows = 8092 cubic inches or 3·648 bushels.

The killow of rice is supposed to weigh 10 okes.

Weight.

			ENGLISH VALUE.
100 drams	make 1 chequee		4950 grains or 0·7072 lbs.
4 chequees	„ 1 oke		19800 „ 2·8286 „
45 okes	„ 1 kintal or cantaro		127·3 lbs.
The rotolo of 18 drams			8910 grains or 1·2729 lbs.

Money.—40 paras make 1 piastre (2¼*d.* sterling).
Piastre of Selim (1801) (13*d.* „).
„ - - - (1818) (9*d.* „).

TUSCANY (ITALY): FLORENCE AND LEGHORN.

Length.

12 denari	make 1 soldo		1·15 inches.
10 soldi	„ 1 palmo		11·49 „ or 0·9575 feet.
2 palmi	„ 1 braccio		22·98 „ 1·9150 „
4 braccia	„ 1 canna		7·66 feet or 2·5533 yards.
5 braccia	„ 1 canna architects and surveyors		9·575 „ 3·1916 „
The miglio is 2833⅓ braccia			5426 „ 1·0277 mile.

Liquid Capacity (Wine, &c.).

2 quartucci	make 1 mezzetta	0·1254 gallons.
2 mezzette	„ 1 boccale	0·2508 „
2 boccali	„ 1 fiasco	0·5016 „
20 fiasci	„ 1 barile weighing 133⅓ libbre	10·032 „

Liquid Capacity (Oil).

2 boccali	make 1 fiasco	0·5016 gallons.
16 fiasci	„ 1 barile weighing 120 libbre	8·026 „
2 barili	make 1 soma	16·052 „

The barile of spirits also weighs 120 libbre.

Dry Capacity.

			ENGLISH VALUE.
2 bussoli	make 1 quartuccio	0·0105 bushels.	
2 quartucci	„ 1 mezzetta	0·0210	„
2 mezzette	„ 1 metadella	0·0419	„
4 metadelle	„ 1 quarto	0·1676	„
2 quarti	„ 1 mina	0·3352	„
2 mine	„ 1 stájo	0·6704	„
3 staja	„ 1 sacco	2·0112	„
8 sacci	„ 1 mòggio	16·0896	„ or 2·0112 quarters.

Weight.

24 grani	make 1 denaro	18·2 grains or 0·0026 lb.	
3 denari	„ 1 dramma	54·6	„ 0·0078 „
8 dramme	„ 1 oncia	436·7	„ 0·0624 „
12 oncie	„ 1 libbra	5240·2	„ 0·7486 „

Money.

100 centesimi make 1 lira (7·82*d.* sterling).
The gold sequin is estimated at 9*s.* 5*d.* sterling.
„ „ rosini „ 17*s.* „
„ „ rusponi „ 28*s.* 5*d.* „

For more recent information see Italy, p. 86.

UNITED STATES (NORTH AMERICA).

The weights and measures of the United States are precisely the same as those of Great Britain, with the exception of the measures of capacity, for which the old standards are still retained. Thus the unit of DRY CAPACITY is the old Winchester bushel = 2150·42 cubic inches = 7·75556 imperial gallons = 0·96944[1] imperial bushel.

Also the unit of LIQUID CAPACITY is the old Wine gallon = 231 cubic inches = 0·83311[1] imperial gallon.

Money.

	ENGLISH VALUE.
100 cents make 1 dollar	50*d.* sterling.
The gold eagle, 10 dollar piece	2*l.* 3*s.* 6*d.* „

[1] $0{\cdot}96944 = 1 - \frac{1}{36}\left(1 + \frac{1}{10}\right)$, and $0{\cdot}83311 = 1 - \frac{1}{6}\left(1 + \frac{1}{1000}\left(1 + \frac{1}{3}\right)\right)$ which expressions may expedite reductions to English imperial measures.

In mercantile transactions between the United States and Great Britain, the dollar is valued at a fixed par of 4*s.* 6*d.* sterling, making 444·44 dollars, equal to 100*l.* sterling; and the variation of exchange is made by a corresponding per centage, premium or discount, on the sterling amounts. But by an Act of Congress, passed July 27, 1842, the Custom-house valuation is fixed at the rate of 4·84 dollars to the pound sterling, thereby making the value of the dollar about 4*s.* 1·6*d.* This compared with the par of 4*s.* 6*d.* per dollar is equal to a premium of nearly 9 per cent.—See British Possessions in North America.

Valencia; see Spain.

VENETIAN LOMBARDY: MILAN AND VENICE.

Length.

	ENGLISH VALUE.
12 atomi make 1 punto	0·16 inches.
12 punti „ 1 oncia	1·95 „
12 oncie „ 1 braccio	23·42 „
Milan foot	15·62 „
Venice „	13·69 „

New Decimal Metric System introduced in 1803.

10 atomi make 1 dito	0·394 inches.
10 diti „ 1 palmo	3·937 „
10 palmi „ 1 metro or braccio	39·3708 „ or 3·2809 feet.
1000 metri „ 1 miglio	1093 63 yards or 0·6214 mile.

Surface.—100 square palmi make 1 tornatura, identical with the French *are*, 119·6 square yards or nearly $\frac{1}{40}$ acre.

Capacity.

10 coppi make 1 pinta	0·2201 gallon or 0·0275 bushel.
10 pinte „ 1 mina	0·2751 bushels.
10 mine „ 1 soma	2·7512 „ or 0·3439 quarter

Weight.

10 grani make 1 denaro	0·0353 oz.
10 denari „ 1 grosso	0·3527 „
10 grossi „ 1 oncia	3·5274 „
10 oncie „ 1 libbra metrica	2·2046 lbs.

For Gold and Silver.

	ENGLISH VALUE.
24 grani make 1 denaro	18·9 grains.
24 denari „ 1 oncia	453·4 „ or 0·9445 oz. troy.
8 oncie „ 1 marco	3627 „ 7·5562 „ „

Money.

5 centesimi	make 1 soldo Austriaca	(0·4*d.* sterling).
20 soldi Austriachi	„ 1 lira Austriaca	(8·1*d.* „).

The value of the lira is the same as the 20 kreuzer piece, or $\frac{1}{3}$rd of the Austrian florin; and therefore the 3 lire piece is of the same value as the florin.

The silver ducat is estimated at		3*s.* 2*d.* sterling.
„ gold sequin (zecchino)	„	9*s.* 5*d.* „
„ „ pistole	„	15*s.* 7*d.* „

For more recent information see Italy, p. 86.
Venice; see Venetian Lombardy.
Verona; see Venetian Lombardy.
Vienna; see Austria.
Warsaw (Poland); see Russia.

WEST INDIES.

The weights and measures are generally those of Great Britain.

Money.—100 cents make 1 dollar (50*d.* sterling). Pounds, shillings, and pence sterling are also used in accounts, the dollar being reckoned at the government par of 4*s.* 2*d.*, as above, and the 16 dollar piece (Spanish onza), known as the doubloon, at 64*s.* sterling.

In most of the West India islands, a fixed valuation was established between the currency and nominal sterling, and the variations of exchange were effected by a per centage on the actual sterling, as at present in the Halifax currency. The legislature, in Jamaica, declared, in 1838, that 166*l.* 13*s.* 4*d.*, Jamaica currency, should represent 100*l.* sterling, the same being in the proportion of 5 to 3, and the

Spanish coinage was regulated accordingly. The late currencies have, however, been abolished in all the islands.

The British currency was established in Bermuda in 1842, and all existing contracts were directed to be settled at the rate of $1\frac{2}{3}l.$ currency per pound sterling, which corresponds with the rate of currency at Jamaica.

WÜRTEMBURG (GERMANY).

Length.

		ENGLISH VALUE.
10 punkte make 1 linie		0·1126 inches.
10 linien „ 1 zoll		1·126 „
10 zolle „ 1 fuss		11·26 „ or 0·9383 foot.
The klafter (6 fuss)	=	5·63 feet.
The ruthe (10 fuss)	=	9·3833 „
The (Stuttgard) elle	=	24·18 inches or 2·015 feet.

Surface.—The morgen (38400 square fuss)=3757 square yards or 0·7763 acre.

Liquid Capacity.

4 schoppen make 1 mass		0·4043 gallons.
10 mass „ 1 immi		4·0432 „
16 immi „ 1 eimer		64·692 „
6 eimer „ 1 fuder		388·15 „

Dry Capacity.

4 viertelein make 1 ecklein		0·0192 bushels.
2 ecklein „ 1 mässlein		0·0384 „
2 mässlein „ 1 achtel		0·0767 „
2 achtel „ 1 viertel		0·1534 „
4 viertel „ 1 simri		0·6136 „
8 simri „ 1 scheffel		4·9090 „

For apothecaries' weight, see Nürnberg.

For the new imperial measures, weights, and moneys, now in use, see Germany, p. 78.

Zurich; see Switzerland.

GENERAL TABLES.

In reducing foreign measures to the corresponding values in other denominations, architects, engineers, and practical men generally, of different countries, often experience considerable perplexity, in consequence of the necessity of frequent and varied references, and the tediousness of arithmetical calculation. The following Tables are designed to simplify and expedite all such reductions. Table I. contains a list of the principal linear measures of the various countries, states, and cities throughout Europe, arranged in an alphabetical order. The names of the places occupy the first column, and the columns of figures on the right exhibit, to four places of decimals, the value of an unit of each respective measure, when estimated in English inches, English feet, Florence braccia, French metres, French pieds, Napolitan palmi, Rhineland feet, Roman palmi, Venice feet, and Vienna feet. Thus, in the line opposite the "Ancona foot," we read that it is equivalent to 15·384 English inches, 1·2820 English feet, 0·6695 parts of a Florence braccio, 0·3908 parts of a metre, 1·2029 French feet, 1·4818 Napolitan palmi, or 1·2449 Rhineland feet, &c. Table II. shows the comparisons of square or superficial measures, on precisely the same plan as Table I.

The following examples will practically exemplify their use.

Example 1. Reduce 326 Bergamo linear feet to the corresponding measure in Rhineland feet.

In Table I., opposite to Bergamo foot, and under Rhineland feet, we see that a Bergamo foot is equal to 1·3896 Rhineland feet. Therefore, multiplying 1·3896 by 326, we get 453·0 for the required measure in Rhineland feet.

Example 2. Reduce 218·54 Frankfort feet into English feet.

Referring to Table I., opposite Frankfort foot, and in the second column under English feet, we observe that a Frankfort foot is equal to 0·9392 parts of an English foot. Therefore, multiplying 218·54 by 0·9392, the result is 205·25 English feet.

Example 3. Reduce 215·36 Malta square feet into Venice square feet.

In Table II., opposite Malta foot and under Venice feet, we take out 0·6656 for the parts of a Venice foot which are measured by one Malta foot. Consequently by multiplying 215·36 by 0·6656, the answer is 143·34 Venice superficial feet.

Example 4. Reduce 562·18 Palermo square palmi to English feet.

Referring to Table II., as before, we find a Palermo square palmo is equal to 0·6308 parts of an English square foot. Hence multiply 562·18 by 0·6308, and the required result is found to be 354·62 English square feet.

TABLE I.

CONVERSION OF STANDARD LINEAR MEASURES.

Linear Measure.	English Inches.	English Feet.	Florence Braccia.	French Mètres.	French Pieds.
Aix-la-Chapelle foot	11·410	0·9508	0·4966	0·2898	0·8921
Amsterdam foot	11·150	0·9292	0·4853	0·2832	0·8719
Ancona foot	15·384	1·2820	0·6695	0·3908	1·2029
Anspach foot	11·720	0·9767	0·5101	0·2977	0·9164
Antwerp foot	11·240	0·9367	0·4892	0·2855	0·8789
Aquileia foot	13·530	1·1275	0·5888	0·3437	1·0579
Augsburg foot	11·650	0·9708	0·5070	0·2959	0·9109
Austria foot	12·445	1·0371	0·5416	0·3161	0·9731
Baden foot	11·811	0·9842	0·5140	0·3000	0·9235
Basle foot	11·740	0·9783	0·5109	0·2982	0·9179
Bavaria foot	11·420	0·9517	0·4970	0·2901	0·8930
Bergamo foot	17·172	1·4310	0·7473	0·4362	1·3427
Berlin foot	12·190	1·0158	0·5305	0·3096	0·9531
Berne foot	11·540	0·9617	0·5022	0·2931	0·9024
Bohemia foot	11·670	0·9725	0·5079	0·2964	0·9125
Bologna foot	14·928	1·2440	0·6497	0·3792	1·1672
Bremen foot	11·380	0·9483	0·4952	0·2890	0·8898
Brescia foot	18·720	1·5600	0·8147	0·4755	1·4637
——— braccio	25·104	2·0920	1 0925	0·6376	1·9629
Breslau foot	11·190	0·9325	0·4870	0·2842	0·8750
Brunswick foot	11·230	0·9358	0·4887	0·2852	0·8781
Brussels foot	11·450	0·9542	0·4983	0·2908	0·8953
Cagliari palmo	7·970	0·6642	0·3469	0·2024	0·6232
Calenberg foot	11·500	0·9583	0·5005	0·2921	0·8992
Carrara palmo	9·808	0·8173	0·4268	0·2491	0·7669
Chamberry foot	13·284	1·1070	0·5781	0·3374	1·0387
China math. foot	13·120	1·0933	0·5710	0·3332	1·0258
——— imp. foot	12·612	1·0510	0·5489	0·3203	0·9861
Clêves foot	11·660	0·9717	0·5075	0·2962	0·9117
Cologne foot	10·830	0·9025	0·4713	0·2751	0·8468

TABLE I.

CONVERSION OF STANDARD LINEAR MEASURES.

Linear Measure.		Napolitan Palmi.	Rhineland Feet.	Roman Palmi.	Venice Feet.	Vienna Feet.
Aix-la-Chapelle	foot	1·0990	0·9233	1·2971	0·8334	0·9168
Amsterdam	foot	1·0740	0·9023	1·2676	0·8145	0·8960
Ancona	foot	1·4818	1·2449	1·7489	1·1237	1·2361
Anspach	foot	1·1289	0·9484	1·3324	0·8561	0·9418
Antwerp	foot	1·0827	0·9096	1·2779	0·8210	0·9032
Aquileia	foot	1·3032	1·0949	1·5382	0·9883	1·0872
Augsburg	foot	1·1221	0·9427	1·3244	0·8509	0·9361
Austria	foot	1·1987	1·0071	1·4148	0·9090	1·0000
Baden	foot	1·1376	0·9557	1·3426	0·8627	0·9490
Basle	foot	1·1308	0·9500	1·3346	0·8575	0·9433
Bavaria	foot	1·1000	0·9242	1·2983	0·8342	0·9177
Bergamo	foot	1·6540	1·3896	1·9522	1·2543	1·3798
Berlin	foot	1·1741	0·9864	1·3858	0·8904	0·9795
Berne	foot	1·1116	0·9339	1·3120	0·8429	0·9273
Bohemia	foot	1·1241	0·9443	1·3267	0·8524	0·9377
Bologna	foot	1·4379	1·2080	1·6971	1·0904	1·1995
Bremen	foot	1·0961	0·9209	1·2937	0·8312	0·9144
Brescia	foot	1·8031	1·5148	2·1281	1·3674	1·5042
———	braccio	2·4180	2·0314	2·8539	1·8337	2·0172
Breslau	foot	1·0778	0·9055	1·2721	0·8174	0·8991
Brunswick	foot	1·0816	0·9087	1·2766	0·8202	0·9023
Brussels	foot	1·1029	0·9266	1·3017	0·8364	0·9201
Cagliari	palmo	0·7677	0·6450	0·9061	0·5822	0·6404
Calenberg	foot	1·1076	0·9306	1·3073	0·8400	0·9240
Carrara	palmo	0·9447	0·7936	1·1150	0·7164	0·7881
Chamberry	foot	1·2794	1·0750	1·5102	0·9703	1·0674
China	math. foot	1·2637	1·0616	1·4915	0·9583	1·0542
———	imp. foot	1·2148	1·0206	1·4338	0·9212	1·0134
Clêves	foot	1·1231	0·9436	1·3256	0·8517	0·9369
Cologne	foot	1·0432	0·8764	1·2312	0·7911	0·8702

Linear Measure.		English Inches.	English Feet.	Florence Braccia.	French Mètres.	French Pieds.
Constantinople	pic	26·800	2·2333	1·1663	0·6807	2·0955
Copenhagen	foot	12·357	1·0298	0·5378	0·3139	0·9663
Cracow	foot	14·032	1·1693	0·6107	0·3564	1·0972
Dantzic	foot	11·290	0·9408	0·4913	0·2868	0·8828
Denmark	foot	12·357	1·0298	0·5378	0·3139	0·9663
Dordrecht	foot	14·160	1·1800	0·6162	0·3597	1·1072
Dresden	foot	11·150	0·9292	0·4853	0·2832	0·8719
Embden	foot	11·660	0·9717	0·5075	0·2962	0·9117
England	foot	12·000	1·0000	0·5222	0·3048	0·9383
Farrari	foot	15·804	1·3170	0·6878	0·4014	1·2357
Florence	foot	11·940	0·9950	0·5196	0·3033	0·9336
———	braccio	22·978	1·9148	1·0000	0·5836	1·7966
France	foot	12·790	1·0658	0·5566	0·3249	1·0000
———	mètre	39·371	3·2809	1·7134	1·0000	3·0784
Frankfort	foot	11·270	0·9392	0·4905	0·2863	0·8813
Geneva	foot	23·028	1·9190	1·0022	0·5849	1·8006
Genoa	palmo	9·808	0·8173	0·4268	0·2491	0·7669
———	canna	87·600	7·3000	3·8123	2·2250	6·8495
Gottingen	foot	11·450	0·9542	0·4983	0·2908	0·8953
Gotha	foot	11·320	0·9433	0·4926	0·2875	0·8851
Greece	foot	11·810	0·9842	0·5140	0·3000	0·9235
Groningen	foot	11·490	0·9575	0·5000	0·2918	0·8984
Hamburg	foot	11·290	0·9408	0·4913	0·2868	0·8828
Hanover	foot	11·450	0·9542	0·4983	0·2908	0·8953
Harlem	foot	11·250	0·9375	0·4896	0·2857	0·8797
Heidelberg	foot	10·960	0·9133	0·4770	0·2784	0·8569
Hildesheim	foot	11·050	0·9208	0·4809	0·2807	0·8640
Inspruck	foot	12·500	1·0417	0·5440	0·3175	0·9774
Königsberg	foot	12·110	1·0092	0·5270	0·3076	0·9469
Leghorn	foot	11·904	0·9920	0·5181	0·3024	0·9308
Leipsic	foot	11·130	0·9275	0·4844	0·2827	0·8703
Leyden	foot	12·340	1·0283	0·5370	0·3134	0·9649
Liege	foot	11·320	0·9433	0·4926	0·2875	0·8851
Lindau	com. foot	11·400	0·9500	0·4961	0·2896	0·8914
———	long foot	12·400	1·0333	0·5396	0·3149	0·9695

Linear Measure.		Napolitan Palmi.	Rhineland Feet.	Roman Palmi.	Venice Feet.	Vienna Feet.
Constantinople	pic	2·5814	2·1687	3·0467	1·9575	2·1534
Copenhagen	foot	1·1903	1·0000	1·4049	0·9026	0·9930
Cracow	foot	1·3515	1·1355	1·5952	1·0249	1·1275
Dantzic	foot	1·0874	0·9136	1·2835	0·8246	0·9072
Denmark	foot	1·1903	1·0000	1·4049	0·9026	0·9930
Dordrecht	foot	1·3639	1·1458	1·6098	1·0343	1·1378
Dresden	foot	1·0740	0·9023	1·2676	0·8145	0·8960
Embden	foot	1·1231	0·9436	1·3256	0·8517	0·9369
England	foot	1·1558	0·9710	1·3642	0·8765	0·9642
Farrari	foot	1·5223	1·2789	1·7967	1·1544	1·2699
Florence	foot	1·1501	0·9662	1·3574	0·8721	0·9594
———	braccio	2·2132	1·8593	2·6122	1·6783	1·8463
France	foot	1·2319	1·0350	1·4540	0·9342	1·0277
———	mètre	3·7922	3·1859	4·4758	2·8757	3·1635
Frankfort	foot	1·0856	0·9120	1·2813	0·8232	0·9056
Geneva	foot	2·2181	1·8635	2·6179	1·6821	1·8504
Genoa	palmo	0·9447	0·7936	1·1150	0·7164	0·7881
———	canna	8·4376	7·0886	9·9586	6·3985	7·0388
Gottingen	foot	1·1029	0·9266	1·3017	0·8364	0·9201
Gotha	foot	1·0903	0·9160	1·2869	0·8268	0·9096
Greece	foot	1·1376	0·9557	1·3426	0·8627	0·9490
Groningen	foot	1·1067	0·9298	1·3062	0·8393	0·9233
Hamburg	foot	1·0874	0·9136	1·2835	0·8246	0·9072
Hanover	foot	1·1029	0·9266	1·3017	0·8364	0·9201
Harlem	foot	1·0836	0·9104	1·2789	0·8217	0·9040
Heidelberg	foot	1·0556	0·8868	1·2459	0·8005	0·8806
Hildesheim	foot	1·0643	0·8941	1·2562	0·8071	0·8879
Inspruck	foot	1·2040	1·0115	1·4211	0·9131	1·0044
Königsberg	foot	1·1665	0·9800	1·3768	0·8846	0·9731
Leghorn	foot	1·1466	0·9633	1·3533	0·8695	0·9565
Leipsic	foot	1·0720	0·9006	1·2653	0·8130	0·8943
Leyden	foot	1·1886	0·9985	1·4028	0·9013	0·9915
Liege	foot	1·0903	0·9160	1·2869	0·8268	0·9096
Lindau	com. foot	1·0980	0·9225	1·2960	0·8327	0·9160
———	long foot	1·1943	1·0034	1·4096	0·9057	0·9963

Linear Measure.		English Inches.	English Feet.	Florence Braccia.	French Mètres.	French Pieds.
Lisbon	archit. foot	13·331	1·1109	0·5802	0·3386	1·0424
———	com. foot	12·960	1·0800	0·5640	0·3292	1·0134
Lombardy	arch. foot	15·611	1·3009	0·6794	0·3965	1·2206
Lorraine	foot	11·300	0·9417	0·4918	0·2870	0·8836
Lübeck	foot	11·450	0·9542	0·4983	0·2908	0·8953
Lucca	braccio	23·496	1·9580	1·0225	0·5968	1·8372
Luneburg	foot	11·450	0·9542	0·4983	0·2908	0·8953
Macedonia	foot	13·918	1·1598	0·6057	0·3535	1·0882
Magdeburg	foot	11·160	0·9300	0·4857	0·2835	0·8726
Malta	foot	11·170	0·9308	0·4861	0·2837	0·8734
Manheim	foot	11·410	0·9508	0·4966	0·2898	0·8921
Mantua	braccio	25·104	2·0920	1·0925	0·6376	1·9629
———	brasso	18·252	1·5210	0·7943	0·4636	1·4272
Maestricht	foot	11·050	0·9208	0·4809	0·2807	0·8640
Mentz	foot	11·850	0·9875	0·5157	0·3010	0·9266
Middleburg	foot	11·810	0·9842	0·5140	0·3000	0·9235
Milan	foot	15·620	1·3017	0·6798	0·3968	1·2214
———	dec. foot	10·260	0·8550	0·4465	0·2606	0·8023
———	braccio	23·420	1·9517	1·0192	0·5949	1·8313
———	metro-braccio	39·371	3·2809	1·7134	1·0000	3·0784
Modena	foot	20·592	1·7160	0·8962	0·5230	1·6101
Monaco	foot	9·250	0·7708	0·4025	0·2349	0·7232
Moscow	foot	13·170	1·0975	0·5732	0·3345	1·0298
Munich	foot	11·490	0·9575	0·5000	0·2918	0·8984
Naples	palmo	10·382	0·8652	0·4518	0·2637	0·8118
Naples	canna	83·055	6·9213	3·6146	2·1096	6·4942
Neufchâtel	foot	11·810	0·9842	0·5140	0·3000	0·9235
Normandy	foot	11·720	0·9767	0·5101	0·2977	0·9164
Nuremberg	foot	11·960	0·9967	0·5205	0·3038	0·9352
Oldenburg	foot	11·650	0·9708	0·5070	0·2959	0·9109
Osnaburg	foot	11·000	0·9167	0·4787	0·2794	0·8601
Padua	foot	13·930	1·1608	0·6062	0·3538	1·0892
Palæste	foot	12·138	1·0115	0·5283	0·3083	0·9491
Palermo	palmo	9·530	0·7942	0·4148	0·2421	0·7452
Parma	foot	22·428	1·8690	0·9761	0·5697	1·7537

Linear Measure.	Napolitan Palmi.	Rhineland Feet.	Roman Palmi.	Venice Feet.	Vienna Feet.
Lisbon archit. foot	1·2840	1·0787	1·5155	0·9737	1·0712
——— com. foot	1·2483	1·0487	1·4733	0·9466	1·0414
Lombardy arch. foot	1·5036	1·2632	1·7747	1·1402	1·2544
Lorraine foot	1·0885	0·9144	1·2847	0·8254	0·9080
Lübeck foot	1·1029	0·9266	1·3017	0·8364	0·9201
Lucca braccio	2·2631	1·9013	2·6711	1·7162	1·8380
Luneburg foot	1·1029	0·9266	1·3017	0·8364	0·9201
Macedonia foot	1·3405	1·1262	1·5822	1·0166	1·1183
Magdeburg foot	1·0749	0·9031	1·2687	0·8152	0·8967
Malta foot	1·0759	0·9039	1·2698	0·8159	0·8975
Manheim foot	1·0990	0·9233	1·2971	0·8334	0·9168
Mantua braccio	2·4180	2·0314	2·8539	1·8337	2·0172
——— brasso	1·7580	1·4770	2·0750	1·3332	1·4666
Maestricht foot	1·0643	0·8941	1·2562	0·8071	0·8879
Mentz foot	1·1414	0·9589	1·3472	0·8656	0·9522
Middleburg foot	1·1376	0·9557	1·3426	0·8627	0·9490
Milan foot	1·5046	1·2640	1·7758	1·1410	1·2551
——— dec. foot	0·9883	0·8303	1·1664	0·7494	0·8244
——— braccio	2·2558	1·8952	2·6625	1·7107	1·8819
——— metro-braccio	3·7922	3·1859	4·4758	2·8757	3·1635
Modena foot	1·9834	1·6663	2·3410	1·5041	1·6546
Monaco foot	0·8909	0·7485	1·0515	0·6756	0·7432
Moscow foot	1·2685	1·0657	1·4972	0·9620	1·0582
Munich foot	1·1067	0·9298	1·3062	0·8393	0·9233
Naples palmo	1·0000	0·8402	1·1803	0·7584	0·8343
Naples canna	8·0000	6·7210	9·4421	6·0667	6·6738
Neufchâtel foot	1·1376	0·9557	1·3426	0·8627	0·9490
Normandy foot	1·1289	0·9484	1·3324	0·8561	0·9418
Nuremberg foot	1·1520	0·9678	1·3597	0·8736	0·9610
Oldenburg foot	1·1221	0·9427	1·3244	0·8509	0·9361
Osnaburg foot	1·0596	0·8902	1·2506	0·8035	0·8839
Padua foot	1·3417	1·1272	1·5836	1·0175	1·1193
Palæste foot	1·1692	0·9822	1·3799	0·8866	0·9753
Palermo palmo	0·9180	0·7712	1·0835	0·6961	0·7658
Parma foot	2·1603	1·8149	2·5497	1·6382	1·8021

Linear Measure.		English Inches.	English Feet.	Florence Braccia.	French Mètres.	French Pieds.
Parma	braccio	21·340	1·7783	0·9287	0·5420	1·6686
Pavia	foot	18·480	1·5400	0·8042	0·4694	1·4450
——	braccio	18·300	1·5250	0·7964	0·4648	1·4309
Persia	arish	38·270	3·1892	1·6655	0·9721	2·9924
Phileterian	foot	13·937	1·1614	0·6065	0·3540	1·0897
Piacenza	foot	22·428	1·8690	0·9761	0·5697	1·7537
Piedmont liprando	ft.	20·228	1·6857	0·8803	0·5138	1·5817
——	common ft.	13·484	1·1237	0·5868	0·3425	1·0544
Poland	foot	14·032	1·1693	0·6107	0·3564	1·0972
Pomerania	foot	11·500	0·9583	0·5005	0·2921	0·8992
Portugal archit.	foot	13·331	1·1109	0·5802	0·3386	1·0424
Prague	foot	11·880	0·9900	0·5170	0·3018	0·9289
Prussia	foot	12·357	1·0298	0·5378	0·3139	0·9663
Pythian	foot	9·749	0·8124	0·4243	0·2476	0·7623
Ratsburg	foot	11·450	0·9542	0·4983	0·2908	0·8953
Revel	foot	10·530	0·8775	0·4583	0·2675	0·8234
Reggio	braccio	20·850	1·7375	0·9074	0·5296	1·6303
Rhineland	foot	12·357	1·0298	0·5378	0·3139	0·9663
Riga	foot	10·790	0·8992	0·4696	0·2741	0·8437
Rimini	braccio	21·390	1·7825	0·9309	0·5433	1·6725
Rome	common foot	11·592	0·9660	0·5045	0·2944	0·9064
——	archit. foot	11·720	0·9767	0·5101	0·2977	0·9164
——	palmo	8·796	0·7330	0·3828	0·2234	0·6878
——	braccio	30·732	2·5610	1·3375	0·7806	2·4030
——	palmo d'archit.	8·790	0·7325	0·3825	0·2233	0·6873
Rome	canna d'archit.	87·900	7·3250	3·8254	2·2326	6·8731
Rostock	foot	11·380	0·9483	0·4952	0·2890	0·8898
Rotterdam	foot	12·357	1·0298	0·5378	0·3139	0·9663
Russia	foot	13·750	1·1458	0·5984	0·3492	1·0751
Sardinia	palmo	9·808	0·8173	0·4268	0·2491	0·7669
Sicily	palmo	9·530	0·7942	0·4148	0·2421	0·7452
——	Archimedes' ft.	8·760	0·7300	0·3812	0·2225	0·6850
Sienna	foot	14·868	1·2390	0·6471	0·3776	1·1625
Spain	foot	11·130	0·9275	0·4844	0·2827	0·8703
Stade	foot	11·450	0·9542	0·4983	0·2908	0·8953

Linear Measure.		Napolitan Palmi.	Rhineland Feet.	Roman Palmi.	Venice Feet.	Vienna Feet.
Parma	braccio	2·0555	1·7268	2·4260	1·5587	1·7147
Pavia	foot	1·7800	1·4954	2·1009	1·3498	1·4849
——	braccio	1·7627	1·4808	2·0804	1·3367	1·4704
Persia	arish	3·6862	3·0968	4·3507	2·7954	3·0751
Phileterian	foot	1·3424	1·1278	1·5844	1·0180	1 1199
Piacenza	foot	2·1603	1·8149	2·5497	1 6382	1·8021
Piedmont liprando ft.		1·9484	1·6369	2·2996	1·4775	1·6254
—— common ft.		1·2988	1·0912	1·5330	0·9849	1·0835
Poland	foot	1·3515	1·1355	1·5952	1·0249	1·1275
Pomerania	foot	1·1076	0·9306	1·3073	0·8400	0·9240
Portugal archit.	foot	1·2840	1·0787	1·5155	0·9737	1·0712
Prague	foot	1·1443	0·9613	1·3506	0·8678	0·9546
Prussia	foot	1·1903	1·0000	1·4049	0·9026	0·9930
Pythian	foot	0·9390	0·7889	1·1083	0·7121	0·7833
Ratsburg	foot	1·1029	0·9266	1·3017	0·8364	0·9201
Revel	foot	1·0143	0·8521	1·1971	0·7691	0·8461
Reggio	braccio	2·0083	1·6872	2·3703	1·5229	1·6753
Rhineland	foot	1·1903	1·0000	1·4049	0·9026	0·9930
Riga	foot	1·0393	0·8732	1·2267	0·7882	0 8670
Rimini	braccio	2·0603	1·7309	2·4317	1·5624	1·7187
Rome common	foot	1·1166	0·9380	1·3178	0·8467	0·9315
—— archit.	foot	1·1289	0·9484	1·3324	0·8561	0·9418
——	palmo	0·8472	0·7118	1·0000	0·6425	0 7068
——	braccio	2·9601	2·4869	3·4937	2·2448	2·4694
—— palmo d'archit.		0·8467	0·7113	0·9993	0·6421	0·7063
Rome canna d'archit.		8·4666	7·1130	9·9929	6·4205	7·0630
Rostock	foot	1·0961	0·9209	1·2937	0·8312	0·9144
Rotterdam	foot	1·1903	1·0000	1·4049	0·9026	0·9930
Russia	foot	1·3244	1·1126	1·5631	1·0043	1·1048
Sardinia	palmo	0·9447	0·7936	1·1150	0·7164	0·7881
Sicily	palmo	0·9180	0·7712	1·0835	0·6961	0·7658
—— Archimedes' ft.		0·8438	0·7089	0·9959	0·6399	0·7039
Sienna	foot	1·4322	1·2031	1·6902	1·0860	1·1947
Spain	foot	1·0720	0·9006	1·2653	0·8130	0·8943
Stade	foot	1·1029	0·9266	1·3017	0·8364	0·9201

Linear Measure.		English Inches.	English Feet.	Florence Braccia.	French. Mètres.	French. Pieds.
Stettin	old foot	11·120	0·9267	0·4840	0·2825	0·8695
Strasburg	foot	11·390	0·9492	0·4957	0·2893	0·8906
Stuttgard	foot	11·260	0·9383	0·4900	0·2860	0·8804
Sweden	foot	11·690	0·9742	0·5088	0·2969	0·9141
Trent	foot	14·412	1·2010	0·6272	0·3661	1·1269
Turin	liprando foot	20·228	1·6857	0·8803	0·5138	1·5817
——	common foot	13·484	1·1237	0·5868	0·3425	1·0544
——	ras	23·496	1·9580	1·0225	0·5968	1·8372
Turkey	pic	26·800	2·2333	1·1663	0·6807	2·0955
Ulm	foot	11·390	0·9492	0·4957	0·2893	0·8906
Utrecht	foot	10·740	0·8950	0·4674	0·2728	0·8398
Venice	foot	13·691	1·1409	0·5958	0·3477	1·0705
Verona	foot	13·404	1·1170	0·5833	0·3405	1·0481
Vicenza	foot	13·632	1·1360	0·5933	0·3463	1·0659
Vienna	foot	12·445	1·0371	0·5416	0·3161	0·9731
Warsaw	foot	11·725	0·9771	0·5103	0·2978	0·9168
——	Cracow foot	14·032	1·1693	0·6107	0·3564	1·0972
Wismar	foot	11·580	0·9650	0·5040	0·2941	0·9055
Würtemberg	foot	11·260	0·9383	0·4900	0·2860	0·8804
Zell	foot	11·450	0·9542	0·4983	0·2908	0·8953
Ziriczee	foot	12·210	1·0175	0·5314	0·3101	0·9547
Zurich	foot	11·810	0·9842	0·5140	0·3000	0·9235

Linear Measure.		Napolitan Palmi.	Rhineland Feet.	Roman Palmi.	Venice Feet.	Vienna Feet.
Stettin	old foot	1 0711	0·8999	1·2642	0·8123	0·8936
Strasburg	foot	1·0971	0·9217	1·2949	0·8320	0·9153
Stuttgard	foot	1·0845	0·9111	1·2800	0·8224	0·9047
Sweden	foot	1·1260	0·9460	1·3290	0·8539	0·9394
Trent	foot	1·3882	1·1662	1·6384	1·0527	1·1580
Turin	liprando foot	1·9484	1·6369	2·2996	1·4775	1·6254
——	common foot	1·2988	1·0912	1·5330	0·9849	1·0835
——	ras	2·2631	1·9013	2·6711	1·7162	1·8880
Turkey	pic	2·5814	2·1687	3·0467	1·9575	2·1534
Ulm	foot	1·0971	0·9217	1·2949	0·8320	0·9153
Utrecht	foot	1·0345	0·8691	1·2210	0·7845	0·8630
Venice	foot	1·3187	1·1079	1·5564	1·0000	1·1001
Verona	foot	1·2911	1·0847	1·5238	0·9791	1·0770
Vicenza	foot	1·3130	1·1031	1·5497	0·9957	1·0954
Vienna	foot	1·1987	1·0071	1·4148	0·9090	1·0000
Warsaw	foot	1·1294	0·9488	1·3330	0·8564	0·9421
———	Cracow foot	1·3515	1·1355	1·5952	1·0249	1·1275
Wismar	foot	1·1154	0·9371	1·3165	0·8458	0·9305
Würtemberg	foot	1·0845	0·9111	1·2800	0·8224	0·9047
Zell	foot	1·1029	0·9266	1·3017	0·8364	0·9201
Ziriczee	foot	1·1761	0·9880	1·3881	0·8918	0·9811
Zurich	foot	1·1376	0·9557	1·3426	0·8627	0·9490

TABLE II.

CONVERSION OF STANDARD SQUARE MEASURES.

Square Measure.	English Square Inches.	English Square Feet.	Florence Square Braccia.	French Square Mètres.	French Square Pieds.
Aix-la-Chapelle foot	130·19	0·9040	0·2466	0·0840	0·7959
Amsterdam foot	124·32	0·8634	0·2355	0·0802	0·7602
Ancona foot	236·67	1·6435	0·4482	0·1527	1·4470
Anspach foot	137·36	0·9539	0·2602	0·0886	0·8398
Antwerp foot	126·34	0·8774	0·2393	0·0815	0·7725
Aquileia foot	183·06	1·2713	0·3467	0·1181	1·1192
Augsburg foot	135·72	0·9425	0·2570	0·0876	0·8297
Austria foot	154·88	1·0756	0·2933	0·0999	0·9469
Baden foot	139·48	0·9686	0·2642	0·0900	0·8528
Basle foot	137·83	0·9571	0·2610	0·0889	0·8426
Bavaria foot	130·42	0·9057	0·2470	0·0841	0·7974
Bergamo foot	294·88	2·0478	0·5585	0·1902	1·8029
Berlin foot	148·60	1·0319	0·2814	0·0959	0·9084
Berne foot	133·17	0·9249	0·2522	0·0859	0·8143
Bohemia foot	136·19	0·9458	0·2579	0·0879	0·8326
Bologna foot	222·85	1·5475	0·4221	0·1438	1·3624
Bremen foot	129·50	0·8993	0·2453	0·0835	0·7917
Brescia foot	350·44	2·4335	0·6637	0·2261	2·1425
——— braccio	630·21	4·3764	1·1936	0·4066	3·8530
Breslau foot	125·22	0·8696	0·2372	0·0808	0·7656
Brunswick foot	126·11	0·8757	0·2388	0·0814	0·7710
Brussels foot	131·10	0·9105	0·2483	0·0846	0·8016
Cagliari palmo	63·52	0·4412	0·1203	0·0410	0·3884
Calenberg foot	132·25	0·9183	0·2505	0·0853	0·8085
Carrara palmo	96·20	0·6680	0·1822	0·0621	0·5881
Chamberry foot	176·46	1·2255	0·3342	0·1138	1·0789
China math. foot	172·13	1·1953	0·3260	0·1110	1·0523
——— imp. foot	159·06	1·1046	0·3013	0·1026	0·9725
Clêves foot	135·96	0·9442	0·2575	0·0877	0·8313
Cologne foot	117·29	0·8145	0·2221	0·0757	0·7171

TABLE II.

CONVERSION OF STANDARD SQUARE MEASURES.

Square Measure.	Napolitan Square Palmi.	Rhineland Square Feet.	Roman Square Palmi.	Venice Square Feet.	Vienna Square Feet.
Aix-la-Chapelle foot	1·2078	0·8524	1·6824	0·6945	0·8405
Amsterdam foot	1·1535	0·8141	1·6069	0·6633	0·8027
Ancona foot	2·1957	1·5497	3·0587	1·2627	1·5281
Anspach foot	1·2744	0·8995	1·7753	0·7329	0·8869
Antwerp foot	1·1722	0·8273	1·6329	0·6741	0·8158
Aquileia foot	1·6984	1·1987	2·3660	0·9767	1·1820
Augsburg foot	1·2591	0·8887	1·7540	0·7241	0·8762
Austria foot	1·4369	1·0142	2·0017	0·8263	1·0000
Baden foot	1·2941	0·9134	1·8027	0·7442	0·9006
Basle foot	1·2786	0·9024	1·7811	0·7353	0·8898
Bavaria foot	1·2100	0·8540	1·6856	0·6959	0·8421
Bergamo foot	2·7358	1·9309	3·8110	1·5733	1·9039
Berlin foot	1·3785	0·9730	1·9203	0·7928	0·9594
Berne foot	1·2356	0·8721	1·7212	0·7106	0·8599
Bohemia foot	1·2635	0·8918	1·7601	0·7266	0·8793
Bologna foot	2·0675	1·4592	2·8800	1·1889	1·4388
Bremen foot	1·2014	0·8480	1·6736	0·6909	0·8361
Brescia foot	3·2512	2·2947	4·5290	1·8696	2·2626
——— braccio	5·8468	4·1267	8·1448	3·3623	4·0689
Breslau foot	1·1617	0·8199	1·6183	0·6681	0·8085
Brunswick foot	1·1699	0·8257	1·6297	0·6728	0·8142
Brussels foot	1·2164	0·8585	1·6945	0·6995	0·8465
Cagliari palmo	0·5894	0·4160	0·8210	0·3389	0·4102
Calenberg foot	1·2269	0·8659	1·7091	0·7055	0·8538
Carrara palmo	0·8924	0·6299	1·2431	0·5132	0·6210
Chamberry foot	1·6372	1·1555	2·2807	0·9415	1·1394
China math. foot	1·5969	1·1271	2·2245	0·9183	1·1113
—— imp. foot	1·4757	1·0415	2·0557	0·8486	1·0270
Clêves foot	1·2614	0·8903	1·7572	0·7254	0·8778
Cologne foot	1·0882	0·7680	1·5159	0·6258	0·7573

Square Measure.		English Square Inches.	English Square Feet.	Florence Square Braccia.	French Square Mètres.	French Square Pieds.
Constantinople	pic	718·24	4·9877	1·3603	0·4634	4·3912
Copenhagen	foot	152·70	1·0605	0·2892	0·0985	0·9336
Cracow	foot	196·90	1·3673	0·3729	0·1270	1·2038
Dantzic	foot	127·46	0·8851	0·2414	0·0822	0·7793
Denmark	foot	152·70	1·0605	0·2892	0·0985	0·9336
Dordrecht	foot	200·51	1·3924	0·3798	0·1294	1·2259
Dresden	foot	124·32	0·8634	0·2355	0·0802	0·7602
Embden	foot	135·96	0·9442	0·2575	0·0877	0·8313
England	foot	144·00	1·0000	0·2727	0·0929	0·8804
Farrari	foot	249·77	1·7345	0·4731	0·1611	1·5271
Florence	foot	142·56	0·9900	0·2700	0·0920	0·8716
———	braccio	527·99	3·6664	1·0000	0·3406	3·2279
France	foot	163·58	1·1360	0·3098	0·1055	1·0000
———	mètre	1550·08	10·7640	2·9358	1·0000	9·4768
Frankfort	foot	127·01	0·8821	0·2406	0·0819	0·7766
Geneva	foot	530·29	3·6826	1·0044	0·3421	3·2422
Genoa	palmo	96·20	0·6680	0·1822	0·0621	0·5881
———	canna	7673·76	53·2900	14·5340	4·9506	46·9160
Gottingen	foot	131·10	0·9105	0·2483	0·0846	0·8016
Gotha	foot	128·14	0·8898	0·2427	0·0827	0·7834
Greece	foot	139·48	0·9686	0·2642	0·0900	0·8528
Groningen	foot	132·02	0·9168	0·2500	0·0852	0·8072
Hamburg	foot	127·46	0·8851	0·2414	0·0822	0·7793
Hanover	foot	131·10	0·9105	0·2483	0·0846	0·8016
Harlem	foot	126·56	0·8789	0·2397	0·0817	0·7738
Heidelberg	foot	120·12	0·8341	0·2275	0·0775	0·7343
Hildesheim	foot	122·10	0·8479	0·2312	0·0788	0·7465
Inspruck	foot	156·25	1·0851	0·2960	0·1008	0·9553
Königsberg	foot	146·65	1·0185	0·2778	0·0946	0·8967
Leghorn	foot	141·71	0·9841	0·2684	0·0914	0·8664
Leipsic	foot	123·88	0·8602	0·2346	0·0799	0·7574
Leyden	foot	152·28	1·0574	0·2884	0·0982	0·9309
Liege	foot	128·14	0·8898	0·2427	0·0827	0·7834
Lindau com.	foot	129·96	0·9025	0·2461	0·0838	0·7945
——— long	foot	153·76	1·0677	0·2912	0·0992	0·9400

Square Measure.	Napolitan Square Palmi.	Rhineland Square Feet.	Roman Square Palmi.	Venice Square Feet.	Vienna Square Feet.
Constantinople pic	6·6635	4·7031	9·2824	3·8320	4·6372
Copenhagen foot	1·4168	1·0000	1·9736	0·8147	0·9860
Cracow foot	1·8267	1·2893	2·5446	1·0505	1·2712
Dantzic foot	1·1825	0·8346	1·6173	0·6800	0·8229
Denmark foot	1·4168	1·0000	1·9736	0·8147	0·9860
Dordrecht foot	1·8602	1·3129	2·5913	1·0697	1·2946
Dresden foot	1·1535	0·8141	1·6069	0·6633	0·8027
Embden foot	1·2614	0·8903	1·7572	0·7254	0·8778
England foot	1·3360	0·9429	1·8611	0·7683	0·9297
Farrari foot	2·3173	1·6355	3·2280	1·3326	1·6126
Florence foot	1·3226	0 9335	1·8425	0·7606	0·9204
——— braccio	4·8983	3·4572	6·8234	2·8168	3·4088
France foot	1·5176	1·0711	2·1141	0·8727	1·0561
——— mètre	14·3810	10·1500	20·0330	8·2699	10·0080
Frankfort foot	1·1785	0·8318	1·6416	0·6777	0·8201
Geneva foot	4·9199	3·4725	6·8536	2·8293	3·4239
Genoa palmo	0·8924	0·6299	1·2431	0·5132	0·6210
——— canna	71·1930	50·2480	99·1745	40·9410	49·5450
Gottingen foot	1·2164	0·8585	1·6945	0·6995	0·8465
Gotha foot	1·1888	0·8390	1·6560	0·6836	0·8273
Greece foot	1·2941	0·9134	1·8027	0 7442	0·9006
Groningen foot	1·2248	0·8645	1·7062	0·7044	0·8524
Hamburg foot	1·1825	0·8346	1·6473	0·6800	0·8229
Hanover foot	1·2164	0·8585	1·6945	0·6995	0·8465
Harlem foot	1·1742	0·8287	1·6357	0·6752	0·8171
Heidelberg foot	1·1143	0·7865	1·5523	0·6408	0·7755
Hildesheim foot	1·1328	0·7995	1·5780	0·6514	0·7883
Inspruck foot	1·4487	1·0232	2·0195	0·8337	1·0089
Königsberg foot	1·3607	0·9604	1·8955	0·7825	0·9469
Leghorn foot	1·3147	0·9279	1·8314	0·7560	0·9149
Leipsic foot	1·1493	0·8111	1·6010	0·6609	0·7998
Leyden foot	1·4127	0·9971	1·9679	0·8124	0 9831
Liege foot	1·1888	0·8390	1·6560	0·6836	0·8273
Lindau com. foot	1·2057	0·8510	1·6796	0·6934	0·8391
——— long foot	1·4265	1·0068	1·9871	0·8203	0 9927

Square Measure.	English Square Inches.	English Square Feet.	Florence Square Braccia.	French Square Mètres.	French Square Pieds.
Lisbon archit. foot	177·72	1·2341	0·3366	0·1147	1·0865
——— com. foot	167·96	1·1664	0·3181	0·1084	1·0269
Lombardy arch. ft.	243·70	1·6923	0·4616	0·1572	1·4899
Lorraine foot	127·69	0·8868	0·2419	0·0824	0·7807
Lübeck foot	131·10	0·9105	0·2483	0·0846	0·8016
Lucca braccio	552·06	3·8337	1·0456	0·3562	3·3752
Luneburg foot	131·10	0·9105	0·2483	0·0846	0·8016
Macedonia foot	193·71	1·3451	0·3669	0·1250	1·1842
Magdeburg foot	124·55	0·8649	0·2359	0·0803	0·7614
Malta foot	124·77	0·8664	0·2363	0·0805	0·7628
Manheim foot	130·19	0·9040	0·2466	0·0840	0·7959
Mantua braccio	630·21	4·3764	1·1936	0·4066	3·8530
——— brasso	333·14	2·3134	0·6310	0·2149	2·0368
Maestricht foot	122·10	0·8479	0·2312	0·0788	0·7465
Mentz foot	140·42	0·9752	0·2660	0·0906	0·8585
Middleburg foot	139·48	0·9686	0·2642	0·0900	0·8528
Milan foot	243·98	1·6944	0·4621	0·1574	1·4918
—— dec. foot.	105·27	0·7310	0·1994	0·0679	0·6436
—— braccio	548·50	3·8091	1·0389	0·3539	3·3535
—— met.-braccio	1550·08	10·7640	2·9358	1·0000	9·4768
Modena foot	424·03	2·9447	0·8031	0·2736	2·5925
Monaco foot	85·56	0·5941	0·1620	0·0552	0·5231
Moscow foot	173·45	1·2045	0·3285	0·1119	1·0604
Munich foot	132·02	0·9168	0·2500	0·0852	0·8072
Naples palmo	107·79	0·7486	0·2042	0·0695	0·6591
——— canna	6898·30	47·9050	13·0653	4·4504	42·1754
Neufchâtel foot	139·48	0·9686	0·2642	0·0900	0·8528
Normandy foot	137·36	0·9539	0·2602	0·0886	0·8398
Nuremberg foot	143·04	0·9934	0·2709	0·0923	0·8746
Oldenburg foot	135·72	0·9425	0·2570	0·0876	0·8297
Osnaburg foot	121·00	0·8403	0·2292	0·0781	0·7398
Padua foot	194·04	1·3475	0·3675	0·1252	1·1853
Palæste foot	147·33	1·0232	0·2790	0·0951	0·9008
Palermo palmo	90·82	0·6308	0·1720	0·0586	0·5553
Parma foot	503·02	3·4932	0·9527	0·3245	3·0754

Square Measure.	Napolitan Square Palmi.	Rhineland Square Feet.	Roman Square Palmi.	Venice Square Feet.	Vienna Square Feet.
Lisbon archit. foot	1·6488	1·1637	2·2968	0·9482	1·1474
——— com. foot	1·5583	1·0998	2·1705	0·8961	1·0844
Lombardy arch. ft.	2·2609	1·5957	3·1495	1·3002	1·5734
Lorraine foot	1·1847	0·8362	1·6504	0·6813	0·8245
Lübeck foot	1·2164	0·8585	1·6945	0·6995	0·8465
Lucca braccio	5·1218	3·6149	7·1348	2·9454	3·5643
Luneburg foot	1·2164	0·8585	1·6945	0·6995	0·8465
Macedonia foot	1·7970	1·2684	2·5033	1·0334	1·2506
Magdeburg foot	1·1555	0·8155	1·6096	0·6645	0·8041
Malta foot	1·1575	0·8170	1·6124	0·6656	0·8055
Manheim foot	1·2078	0·8524	1·6824	0·6945	0·8405
Mantua braccio	5·8468	4·1267	8·1448	3·3623	4·0689
——— brasso	3·0907	2·1814	4·3055	1·7774	2·1509
Maestricht foot	1·1328	0·7995	1·5780	0·6514	0·7883
Mentz foot	1·3028	0·9195	1·8148	0·7492	0·9067
Middleburg foot	1·2941	0·9134	1·8027	0·7442	0·9006
Milan foot	2·2637	1·5977	3·1534	1·3018	1·5754
—— dec. foot.	0·9767	0·6893	1·3605	0·5616	0·6797
—— braccio	5·0889	3·5917	7·0890	2·9264	3·5414
—— met.-braccio	14·3810	10·1500	20·0330	8·2699	10·0080
Modena foot	3·9340	2·7766	5·4802	2·2624	2·7378
Monaco. foot	0·7937	0·5620	1·1057	0·4565	0·5524
Moscow foot	1·6092	1·1357	2·2416	0·9254	1·1199
Munich foot	1·2248	0·8645	1·7062	0·7044	0·8524
Naples palmo	1·0000	0·7059	1·3932	0·5751	0·6960
——— canna	64·0000	45·1710	89·1540	36·8040	44·5390
Neufchâtel foot	1·2941	0·9134	1·8027	0·7442	0·9006
Normandy foot	1·2744	0·8995	1·7753	0·7329	0·8869
Nuremberg foot	1·3272	0·9367	1·8488	0·7632	0·9236
Oldenburg foot	1·2591	0·8887	1·7540	0·7241	0·8762
Osnaburg foot	1·1227	0·7924	1·5639	0·6456	0·7813
Padua foot	1·8002	1·2706	2·5077	1·0352	1·2528
Palæste foot	1·3669	0·9648	1·9041	0·7861	0·9513
Palermo palmo	0·8427	0·5948	1·1739	0·4846	0·5864
Parma foot	4·6668	3·2938	6·5010	2·6837	3·2477

Square Measure.	English Square Inches.	English Square Feet.	Florence Square Braccia.	French Square Mètres.	French Square Pieds.
Parma braccio	455·40	3·1624	0·8625	0·2938	2·7842
Pavia foot	341·51	2·3716	0·6468	0·2203	2·0880
—— braccio	334·89	2·3256	0·6343	0·2161	2·0475
Persia arish	1464·59	10·1710	2·7740	0·9449	8·9545
Phileterian foot	194·24	1·3488	0·3679	0·1253	1·1875
Piacenza foot	503·02	3·4932	0·9527	0·3245	3·0754
Piedmont lipr. ft.	409·17	2·8416	0·7750	0·2640	2·5017
—— com. ft.	181·82	1·2627	0·3444	0·1173	1·1117
Poland foot	196·90	1·3673	0·3729	0·1270	1·2038
Pomerania foot	132·25	0·9183	0·2505	0·0853	0·8085
Portugal arch. ft.	177·72	1·2341	0·3366	0·1147	1·0865
Prague foot	141·13	0·9801	0·2673	0·0911	0·8629
Prussia foot	152·70	1·0605	0·2892	0·0985	0·9336
Pythian foot	95·04	0·6600	0·1800	0·0613	0·5811
Ratsburg foot	131·10	0·9105	0·2483	0·0846	0·8016
Revel foot	110·88	0·7700	0·2100	0·0715	0·6779
Reggio braccio	434·72	3·0188	0·8233	0·2805	2·6578
Rhineland foot	152·70	1·0605	0·2892	0·0985	0·9336
Riga foot	116·42	0·8086	0·2205	0·0751	0·7119
Rimini braccio	457·53	3·1773	0·8666	0·2952	2·7973
Rome com. foot	134·37	0·9332	0·2545	0·0867	0·8216
—— archit. foot	137·36	0·9539	0·2602	0·0886	0·8398
—— palmo	77·37	0·5373	0·1465	0·0499	0·4730
—— braccio	944·46	6·5587	1·7888	0·6093	5·7743
—— palmo d'arch.	77·26	0·5366	0·1463	0·0498	0·4724
Rome canna d'arc.	7726·41	53·6560	14·6340	4·9847	47·2390
Rostock foot	129·50	0·8993	0·2453	0·0835	0·7917
Rotterdam foot	152·70	1·0605	0·2892	0·0985	0·9336
Russia foot	189·06	1·3129	0·3581	0·1220	1·1558
Sardinia palmo	96·20	0·6680	0·1822	0·0621	0·5881
Sicily palmo	90·82	0·6308	0·1720	0·0586	0·5553
—- Archimedes' ft.	76·74	0·5329	0·1453	0·0495	0·4692
Sienna foot	221·06	1·5351	0·4187	0·1426	1·3515
Spain foot	123·88	0·8602	0·2346	0·0799	0·7574
Stade foot	131·10	0·9105	0·2483	0·0846	0·8016

Square Measure.	Napolitan Square Palmi.	Rhineland Square Feet.	Roman Square Palmi.	Venice Square Feet.	Vienna Square Feet.
Parma braccio	4·2249	2·9819	5·8855	2·4296	2·9402
Pavia foot	3·1684	2·2362	4·4137	1·8220	2·2050
—— braccio	3·1070	2·1929	4·3281	1·7867	2·1622
Persia arish	13·5880	9·5905	18·9290	7·8141	9·4563
Phileterian foot	1·8020	1·2719	2·5103	1·0363	1·2541
Piacenza foot	4·6668	3·2938	6·5010	2·6837	3·2477
Piedmont lipr. ft.	3·7963	2·6794	5·2883	2·1831	2·6419
—— com. ft.	1·6869	1·1906	2·3500	0·9701	1·1740
Poland foot	1·8267	1·2893	2·5446	1·0505	1·2712
Pomerania foot	1·2269	0·8659	1·7091	0·7055	0·8538
Portugal arch. ft.	1·6488	1·1637	2·2968	0·9482	1·1474
Prague foot	1·3094	0·9242	1·8241	0·7530	0·9113
Prussia foot	1·4168	1·0000	1·9736	0·8147	0·9860
Pythian foot	0·8817	0·6223	1·2283	0·5071	0·6136
Ratsburg foot	1·2164	0·8585	1·6945	0·6995	0·8465
Revel foot	1·0287	0·7261	1·4330	0·5916	0·7159
Reggio braccio	4·0331	2 8466	5·6182	2·3193	2·8067
Rhineland foot	1·4168	1·0000	1·9736	0·8147	0·9860
Riga foot	1·0802	0·7624	1·5048	0·6212	0·7518
Rimini braccio	4·2448	2·9960	5·9132	2·4411	2·9541
Rome com. foot	1·2467	0·8799	1·7367	0·7169	0·8676
—— archit. foot	1·2744	0·8995	1·7753	0·7329	0·8869
—— palmo	0·7178	0·5066	1·0000	0·4128	0·4995
—— braccio	8·7623	6·1844	12·2060	5·0389	6·0979
—— palmo d'arch.	0·7168	0·5059	0·9986	0·4122	0·4989
Rome canna d'arc.	71·6840	50·5940	99·8570	41·2230	49·8860
Rostock foot	1·2014	0·8480	1·6736	0·6909	0·8361
Rotterdam foot	1·4168	1·0000	1·9736	0·8147	0·9860
Russia foot	1·7540	1·2379	2·4433	1·0086	1·2206
Sardinia palmo	0·8924	0·6299	1·2431	0·5132	0·6210
Sicily palmo	0·8427	0·5948	1·1739	0·4846	0·5864
—-Archimedes' ft.	0·7119	0·5025	0·9917	0·4094	0·4955
Sienna foot	2·0509	1·4475	2·8569	1·1794	1·4272
Spain foot	1·1493	0·8111	1·6010	0·6609	0·7998
Stade foot	1·2164	0·8585	1·6945	0·6995	0·8465

Square Measure.		English Square Inches.	English Square Feet.	Florence Square Braccia.	French Square Mètres.	French Square Pieds.
Stettin	old foot	123·65	0·8588	0·2342	0·0798	0·7561
Strasburg	foot	129·73	0·9010	0·2457	0·0837	0·7932
Stuttgard	foot	126·79	0·8804	0·2401	0·0818	0·7751
Sweden	foot	136·66	0·9491	0·2588	0·0882	0·8356
Trent	foot	207·71	1·4424	0·3934	0·1340	1·2699
Turin	liprando foot	409·17	2·8416	0·7750	0·2640	2·5017
——-	com. foot	181·82	1·2627	0·3444	0·1173	1·1117
——-	ras	552·06	3·8337	1·0456	0·3562	3·3752
Turkey	pic	718·24	4·9877	1·3603	0·4634	4·3912
Ulm	foot	129·73	0·9010	0·2457	0·0837	0·7932
Utrecht	foot	115·35	0·8010	0·2185	0·0744	0·7052
Venice	foot	187·44	1·3017	0·3550	0·1209	1·1460
Verona	foot	179·67	1·2477	0·3403	0·1159	1·0984
Vicenza	foot	185·83	1·2905	0·3520	0·1199	1·1362
Vienna	foot	154·88	1·0756	0·2933	0·0999	0·9469
Warsaw	foot	137·48	0·9547	0·2604	0·0887	0·8405
———	Cracow foot	196·90	1·3673	0·3729	0·1270	1·2038
Wismar	foot	134·10	0·9312	0·2540	0·0865	0·8199
Würtemberg	foot	126·79	0·8804	0·2401	0·0818	0·7751
Zell	foot	131·10	0·9105	0·2483	0·0846	0·8016
Ziriczee	foot	149·08	1·0353	0·2824	0·0962	0·9115
Zurich	foot	139·48	0·9686	0·2642	0·0900	0·8528

Square Measure.	Napolitan Square Palmi.	Rhineland Square Feet.	Roman Square Palmi.	Venice Square Feet.	Vienna Square Feet.
Stettin old foot	1·1473	0·8098	1·5982	0·6598	0·7984
Strasburg foot	1·2037	0·8496	1·6768	0·6922	0·8377
Stuttgard foot	1·1762	0·8302	1·6385	0 6764	0·8185
Sweden foot	1·2679	0·8949	1·7663	0·7292	0·8824
Trent foot	1·9270	1·3601	2·6844	1·1082	1·3410
Turin liprando foot	3·7963	2 6794	5·2883	2·1831	2·6419
——- com. foot	1·6869	1·1906	2·3500	0·9701	1·1740
——- ras	5·1218	3·6149	7·1348	2·9454	3·5643
Turkey pic	6·6635	4·7031	9·2824	3·8320	4·6372
Ulm foot	1·2037	0·8496	1·6768	0·6922	0·8377
Utrecht foot	1·0701	0·7553	1·4907	0·6154	0·7447
Venice foot	1·7390	1·2274	2·4225	1·0000	1·2102
Verona foot	1·6669	1·1765	2·3220	0·9586	1·1600
Vicenza foot	1·7241	1·2169	2·4017	0·9915	1·1998
Vienna foot	1·4369	1·0142	2·0017	0·8263	1·0000
Warsaw foot	1·2755	0·9002	1·7768	0·7335	0·8876
——— Cracow foot	1·8267	1·2893	2·5446	1·0505	1·2712
Wismar foot	1·2441	0·8781	1·7331	0·7155	0·8658
Würtemberg foot	1·1762	0·8302	1·6385	0·6764	0·8185
Zell foot	1·2164	0·8585	1·6945	0·6995	0·8465
Ziriczee foot	1·3831	0·9762	1·9267	0·7954	0·9625
Zurich foot	1·2941	0·9134	1·8027	0·7442	0·9006

TABLE III.

ITINERARY OR ROAD MEASURES.

Distance.		English Yards.	English Miles.
Arabia	mile, 6000 Arabian feet . .	2146	1·2193
„	baryd, of 4 farsakh	21120	12·0000
Austria	mile, post, 24,000 Vienna feet	8297	4·7142
„	„ marine, 60 to the degree	2025	1·1508
Baden	„	9721	5·5234
„	„ post, 14,815 Baden feet	4860	2·7617
Bavaria	„ 25,046 Bavarian feet .	8059	4·5792
„	„ of Anspach	9443	5·3652
Belgium	„ old measure	2132	1·2111
„	„ marine, 60 to the degree	2025	1·1508
„	„ metrical (kilomètre) .	1094	0·6214
„	league, 20 to the degree . .	6076	3·4522
Berne, Switzerland,	league, 18,000 Berne feet	5770	3·2784
Birmah	dain or league, 1000 dhas . .	4278	2·4306
Bohemia	league, 16 to the degree . .	7595	4·3154
„	„ 12 „ „ . .	10126	5·7534
Brabant	„ 20 „ „ . .	6076	3·4522
Brazil	„ 18 „ „ . .	6751	3·8360
Bremen	mile, 20,000 Rhenish feet .	6865	3·9006
Brunswick	„ 34,424 „ „ . .	11816	6·7140
China	li, or mile	609	0·3458
Dantzic	mile, 27,000 Dantzic feet .	8467	4·8110
Denmark	„ 12,000 alns	8238	4·6807
„	league, 14½ to the degree . .	8381	4·7618
East Indies:	Bengal coss or mile, 1000 fathoms	2000	1·1364
England	mile, statute	1760	1·0000
„	„ geographical, 60 to the degree	2025	1·1508
„	league „ 20 „ „	6076	3·4523
Flanders	„ 20,000 Rhein-fuss . .	6865	3·9006
France	mile, old measure	2132	1·2111
„	„ marine, 60 to the degree	2025	1·1508
„	„ metrical (kilomètre) . .	1094	0·6214
„	league, post, 2000 ancient toises	4263	2·4222
„	post (2 post leagues) . . .	8527	4·8445

Distance.		English Yards.	English Miles.
France	league, common, 25 to the degree	4861	2·7617
„	„ marine, 20 „ „	6076	3·4521
„	„ mean, 2450 toises .	5223	2·9674
Genoa	post, of 4000 French toises .	8527	4·8445
Germany	mile, geographical, 15 to the degree	8101	4·6030
„	post (2 German miles) . . .	16203	9·2060
„	mile long, 12 to the degree . .	10126	5·7534
„	„ short	6859	3·8972
„	„ metric, 1500 metres . .	1640	0·9320
Hamburg	„ 24,000 Rhenish feet . .	8238	4·6807
Hanover	„ old measure, 18,192 elles .	11572	6·5750
„	„ (since 1818) 11,700 „ .	7442	4·2287
„	„ of 25,400 Calenberg feet .	8114	4·6102
Hebrew ancient	Eastern mile of 4000 cubits	2432	1·3820
Holland	mile, old measure, 19 to the degree	6396	3·6340
„	„ marine, 20 „ „	6076	3·4521
„	„ legal (Netherlandic) . .	1094	0·6214
Holstein	„ 12,000 alns	8238	4·6807
Hungary	„ league, 13½ to the degree	9002	5·1145
India	Bengal coss or mile, 1000 fathoms	2000	1·1364
„	league . . . . . 30 to the degree	4051	2·3015
„	Carnatic league, 35 „ „	3472	1·9727
Ireland	old mile, 320 poles of 7 yards	2240	1·2727
Italy	mile, 60 to the degree . . .	2025	1·1508
„	post, of 8 Italian miles . . .	16203	9·2062
Lithuania	league, 12·44 to the degree .	9769	5·5503
Livonia	„ 17 to the degree . .	7148	4·0615
Lombardo-Veneto,	metrical mile (kilomètre)	1094	0·6214
Lübeck	mile, marine	2028	1·1520
Mecklenburg	„	8238	4·6807
„	league, 12 to the degree . .	10126	5·7534
Naples	mile, of 7000 palmi	2018	1·1468
Netherlands	„ metrical (kilomètre) . .	1094	0·6214
Norway	„	12182	6·9216
Oldenberg	„ 30,000 Oldenberg feet .	9708	5·5160
Persia	parasang, 20 to the degree .	6076	3·4522
Piedmont	post, of 4000 French toises .	8527	4·8445
Poland	league, long, 15 to the degree	8101	4·6028
„	„ short, 20 „ „	6076	3·4521
Portugal	mile . . 54 „ „	2250	1·2787

Distance.		English Yards.	Miles.
Portugal	mile, marine, 60 to the degree	2025	1·1508
„	league (3 miles), 18 „ „	6751	3·8360
„	„ marine, 20 „ „	6076	3·4521
Prussia	mile, of 24,000 Rhineland feet	8238	4·6807
„	„ geographical, 15 to the degree	8101	4·6028
Rome	„ 74½ to the degree . .	1630	0·9261
„	„ metrical (kilomètre) . .	1094	0·6214
„	„ geographical, 60 to the degree	2025	1·1508
„	ancient millārium, 1000 Roman-passus or paces, or 5000 ancient feet	1614	0·9170
Russia	werst or verst, 500 sachines .	1167	0·6629
„	Lithuania mile, 28,530 Rhein-fuss	9793	5 5641
Sardinia	mile, 4333⅓ piede liprando .	2435	1·3834
Saxony	post mile, 24,000 fuss . . .	7432	4·2227
„	league, 12½ to the degree . .	9853	5·5985
Scotland	old mile, 1920 Scotch ells . .	1977	1·1230
Siam, Asia	roëneng, 2000 vouahs . . .	4204	2·3886
Silesia	mile	7086	4·0260
„	league, 1125 Silesian ells, being 17 to the degree . . .	7148	4·0615
Spain	mile	1522	0·8648
„	„ marine, 60 to the degree	2025	1·1508
„	league, common, 8000 varas .	7419	4·2152
„	„ legal, 5000 „ 26⅔ to the degree	4637	2·6345
„	„ marine, 20 „ „	6076	3·4523
Suabia or Swabia:	mile, 12 „ „	10126	5·7534
Sweden	mile, 6000 Swedish fathoms .	11690	6·6423
Switzerland	mile, 26,666⅔ fuss	8548	4·8568
„	league, 13·3 to the degree . .	9137	5·1915
Tuscany	mile, 2833⅓ bracci	1809	1·0277
Turkey	berri, 66½ to the degree . .	1827	1·0383
United States of North America		1760	1·0000
Weimar	mile	7443	4·2292
Westphalia	league, 10 to a degree . . .	12152	6·9046
Würtemberg	mile, 26,000 Stuttgard feet .	8132	4·6206

MEASURES OF TIME.

TIME, in the abstract, is truly measured by the space or distance described by a moving body or machine when the velocity of the same is sustained with perfect uniformity.

A SOLAR DAY is measured by the duration of a complete rotation of the earth round its axis with respect to the sun. The motion of the earth's rotation in space is uniform; but as it is here estimated with reference to the sun, it is affected by the movement of the earth in its orbit round the sun, the velocity of which is subject to a gradual acceleration and retardation, both on account of the ellipticity of the orbit and of the perturbations produced by the planets. To obviate this fluctuation, clocks are adjusted to an average or mean solar day, which is subdivided as follows:—

60 seconds	make	1 minute
60 minutes	„	1 hour
24 hours	„	1 day.

In astronomical reckoning the day is supposed to commence at noon, and is counted throughout the twenty-four hours.

In civil reckoning the day commences at midnight, and is divided into two equal portions of twelve hours each, called morning and evening.

A WEEK is a period of seven days, and has been in use amongst eastern countries to the remotest periods of antiquity. The English names of these days are Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, and Saturday.

A SOLAR YEAR, also called a tropical or civil year, is determined by a revolution of the earth in its orbit round the sun, estimated with respect to the sun and the equinox. In ordinary phraseology it is the time in which the sun moves from the vernal equinox to the vernal equinox again,

and its average value, called a MEAN SOLAR YEAR, has been found by astronomers to be 365·24222 mean solar days, or 365 days 5 hours 48 min. 48 sec.

A CALENDAR MONTH is an interval varying from 28 to 31 days, and was probably first derived from the synodic revolution of the moon, or lunar month according to the periodical phases, the mean value of which period has been found to be 29·5305887 days, or 29 days 12 hours 44 min. 2·8 sec. The year is divided into twelve calendar months, each of which consists of an integral number of days, viz. :—

January	31	days
February	28	„
March	31	„
April	30	„
May	31	„
June	30	„
July	31	„
August	31	„
September	30	„
October	31	„
November	30	„
December	31	„
	365	days.

A BISSEXTILE YEAR, frequently called *leap-year*, consists of 366 days, an additional day being intercalated in the month of February, which is then made 29 days. This is occasionally required for the purpose of adjusting the calendar, so that the course of the seasons and the labours of agriculture, which depend on the situation of the sun, shall be correctly indicated. Before the time of Julius Cæsar, the Roman calendar was in great confusion, and, guided by Sosigenes, his astronomer, he adjusted it by making every fourth civil year into a bissextile of 366 days. The correction so made is called the *Julian correction*, and the

length of a mean Julian year, or year of the Julian Calendar, is hence $365\frac{1}{4}$ or 365·25 days.

In the Ecclesiastical Calendar the intercalary day is placed between the 24th and 25th of February; in the Civil Calendar it is accounted the 29th.

THE GREGORIAN CALENDAR.

Independently of the gradual and progressive improvement in astronomical knowledge and astronomical data, the length of the mean Julian year was practically ascertained to be in excess of the actual mean solar or tropical year, which contains only 365·24222 days; and it was found that the vernal equinox, which, at the Council of Nice, in the year 325, was supposed to correspond to the 21st of March [1], after the lapse of about 1200 years, had retrograded to the 11th. To get rid of the accumulated error, and so restore the equinox to its supposed former place, Pope Gregory XIII., in 1582, directed ten days to be suppressed in the calendar, by calling the 5th of October the 15th for that year; and as the error of the Julian intercalation, according to the calculations of Aloysius Lilius, a celebrated astronomer and physician of Naples, was found to amount to about three days in 400 years, it was ordered that the intercalations on centenary years should thenceforward be omitted, excepting those which are multiples of 400. This important adjustment is usually called the *reformation of the calendar*, and it has since been adopted in almost all Christian countries, under the name of the *Gregorian Calendar*, or *New Style*, the Julian Calendar formerly in use being called the *Old Style*.

For the sake of distinctness we shall here state the Gregorian rule of intercalation.

1. For years that are not even centuries:

If the year, when divided by 4, leaves a remainder, such

[1] There is some slight inaccuracy in this; but it is of no consequence.

year is ordinary; if there be no remainder, the year is bissextile.

2. For years that are even centuries:

If the number of centuries, when divided by 4, leaves a remainder, the year is ordinary; if there be no remainder, it is bissextile.

Thus, 1857, 1858, 1859, 1861 are ordinary;
1856, 1860, 1864, 1868 are bissextile.

Also, 1900, 2100, 2200, 2300 are ordinary;
2000, 2400, 2800, 3200 are bissextile.

Hence every period of 400 years consists of

97	bissextile years or	35502 days,
303	ordinary „	110595 „
		146097 days;

and therefore, taking the 400th part of this number, an average or mean Gregorian year is 365·24250 days.

Now the actual value of the mean solar or tropical year is 365·24222 days, so that the Gregorian rule causes the year to be only 0·00028 day in excess, which will amount to a day in about 3600 years[2]. This small error might be corrected by carrying the rule one step further and changing multiples of 4000 into ordinary years instead of bissextiles.

The Gregorian Calendar was immediately adopted in Denmark, France, Holland, Italy, Portugal, and Spain, as well as by Catholics in other countries. It was established in Germany and Switzerland in 1700, and was not adopted in Great Britain until the year 1752, no less than 170 years after its first formation.

The Act of Parliament passed in 1751, and is entitled "An Act for regulating the Commencement of the Year, and for correcting the Calendar now in use." The preamble recites,

[2] The Julian error (0·00778 day in excess) amounts to a day in 129 years.

that according to the legal supputation in England, the year began on the 25th of March; that this practice had produced various inconveniences, not only from its differing from the usage of neighbouring nations, but also from the legal computation in Scotland, and from the common usage throughout the whole kingdom; that the Julian Calendar then in use had been discovered to be erroneous, by means whereof the vernal or spring equinox, which at the time of the General Council of Nice, A.D. 325, happened on the 21st of March, now fell on the 9th or 10th of that month; that this error was still increasing; that a method of correcting the calendar had been received and established, and was generally practised by almost all other nations of Europe; and that it would be of general convenience to merchants and others corresponding with foreign nations if the like correction were received and established in his Majesty's dominions. It was therefore enacted,

1. That throughout all his Majesty's dominions in Europe, Asia, Africa, and America, the supputation according to which the year of our Lord began on the 25th of March shall not be used after the last day of December, 1751, and that the 1st day of January next following shall be reckoned as the 1st day of the year 1752, and so in all future years.

2. That from and after the 1st day of January, 1752, the several days of each month shall go on and be reckoned and numbered in the same order, and the feast of Easter and other moveable feasts thereon depending shall be ascertained according to the same method, as they now are, until the 2nd of September, 1752; that the natural day next immediately following the 2nd of September, 1752, shall be called and reckoned as the *fourteenth* day of September, omitting the eleven intermediate nominal days of the common calendar; that the days which follow next after the said 14th of September shall be reckoned in numerical order from that day; and all public and private proceedings whatsoever after the 1st of January, 1752, were ordered to be dated accordingly.

3. That the several years of our Lord 1800, 1900, 2100, 2200, 2300, or any other hundredth years of our Lord which shall happen in time to come (excepting only every fourth hundredth year of our Lord, whereof the year 2000 shall be the first), shall not be deemed Bissextile or Leap-years, but shall be considered as common years, consisting of 365 days only; and that the years of our Lord 2000, 2400, 2800, and every other fourth hundredth year of our Lord, from the year 2000 inclusive, and also all other years of our Lord, which by the present supputation are considered bissextile or leap-years, shall for the future be esteemed bissextile or leap-years, consisting of 366 days.

4. That whereas according to the rule then in use for calculating Easter-day, that feast was fixed to the first Sunday after the first full moon next after the 21st of March; and if the full moon happens on a Sunday, then Easter-day is the Sunday after, which rule had been adopted by the General Council of Nice, A.D. 325; but as the method of computing the full moons then used in the Church of England, and according to which the table to find Easter prefixed to the Book of Common Prayer was formed, had become considerably erroneous, it was enacted that the said method should be discontinued, and that from and after the 2nd of September, 1752, Easter-day, and the other moveable and other feasts, were henceforward to be reckoned according to the Calendar, Tables, and Rules annexed to the Act, and attached to the Books of Common Prayer.

Difference of Style.—From 1582 to 1700 the difference of style continued to be 10 days; but 1700 being bissextile in the Julian Calendar and ordinary in the Gregorian, the difference of the styles from 1700 to 1800 was 11 days. The Julian leap-year 1800 was also ordinary in the Gregorian Calendar, and therefore the difference during the present century is 12 days. After 1900 it will be 13 days, and will so continue till 2100, because the year 2000 will be a leap-

year in both styles. Thus if c denote the number of completed centuries, the number of days' difference between the old and new styles, which has accumulated since the second century, will be correctly represented by the formula,

$$c - \binom{c}{4}_w - 2,$$

where w denotes the integral quotient of $\frac{c}{4}$, rejecting any fraction or remainder.

Hence the following table, the extension of which is evident without calculation :—

Date.	Difference.	Date.	Difference.
1500 to 1700	10 days	2900 to 3000	20 days
1700 „ 1800	11 „	3000 „ 3100	21 „
1800 „ 1900	12 „	3100 „ 3300	22 „
1900 „ 2100	13 „	3300 „ 3400	23 „
2100 „ 2200	14 „	3400 „ 3500	24 „
2200 „ 2300	15 „	3500 „ 3700	25 „
2300 „ 2500	16 „	3700 „ 3800	26 „
2500 „ 2600	17 „	3800 „ 3900	27 „
2600 „ 2700	18 „	3900 „ 4100	28 „
2700 „ 2900	19 „	&c.	&c.

The difference requires to be added to the day of the month according to the old style to deduce the same day in the new style, and *vice versâ*. Thus 1872, June 10, old style, is the same day as 1872, June 22, new style.

Dominical Letter.—The dominical or Sunday letter is one of the first seven letters of the alphabet, and is used for the purpose of determining the day of the week corresponding to any given date. In the Ecclesiastical Calendar the first letter A is placed opposite to the first day of the year or January 1, the second letter B is placed opposite the second day or January 2, and so on through the seven letters; after which they are in like manner repeated over and over again

to the end of the year. Then the letter which falls opposite the first Sunday in the year will also fall opposite every following Sunday throughout the year, because the number of letters is the same as the number of days in the week. In ordinary years the letter so indicated is the dominical letter. But in bissextile or leap-years an interruption takes place in the order of the letters on account of the intercalary day, and it is made as a matter of convenience in chronological tabulations. As the intercalary day falls on the 24th of February, the 24th and 25th days are denoted by the same letter, so that after the 24th day of February the dominical letter goes back one place. In the Civil Calendar, however, according to which calculations are generally made, the intercalary day is supposed to be added at the end of February, so that the change of letter takes place on entering March.

As an ordinary year contains 365 days or 52 weeks and 1 day over, and a bissextile year contains 52 weeks and 2 days over, it is evident from the foregoing account that for a series of consecutive years the dominical letters stand in a retrograde order, and go back one letter after every ordinary year and two letters after a bissextile year, the first change in the latter case occurring at the intercalary day, and the second at the end of the year. Thus a bissextile or leap-year has always two dominical letters, one to be used before and the other after the intercalary day.

For any proposed year Y of the Gregorian Calendar, at any near or remote period of time, let c denote the number of completed centuries and y the year of the current century, so that $Y = 100\,c + y$; then the number of bissextile years, from the year 1 of the calendar up to the year Y inclusive, will be $\left(\frac{Y}{4}\right)_w - c + \left(\frac{c}{4}\right)_w$, and the dominical letter may be determined in the following manner :—

From the year 0 to the year $Y = 100\,c + y$ the total number of intervening years is Y, and, if ordinary and bissextile

years are separately enumerated, the numbers are, according to what precedes—

$$\text{Ordinary years} \quad = Y - \left\{ \left(\frac{Y}{4}\right)_w - c + \left(\frac{c}{4}\right)_w \right\}$$

$$\text{Embolismic years} = \quad \left(\frac{Y}{4}\right)_w - c + \left(\frac{c}{4}\right)_w$$

In passing from January 1 of the year 0 to January 1 of the proposed year Y, the advancement of the day of the week, consisting of one day for every ordinary year, and two days for every intervening bissextile year, is obviously—

$$= Y + \left\{ \left(\frac{Y}{4}\right)_w - c + \left(\frac{c}{4}\right)_w \right\} \quad \text{rejecting sevens}$$

$$= (100c + y) + \left\{ \left(\frac{100c+y}{4}\right)_w - c + \left(\frac{c}{4}\right)_w \right\} \quad \text{,,} \quad \text{,,}$$

$$= 124c + y + \left(\frac{y}{4}\right)_w + \left(\frac{c}{4}\right)_w \quad \text{,,} \quad \text{,,}$$

But as $\left(\frac{c}{4}\right)_w$ denotes the quotient and $\left(\frac{c}{4}\right)_r$ the remainder, when the number c is divided by 4, we have the relation

$$4\left(\frac{c}{4}\right)_w = c - \left(\frac{c}{4}\right)_r$$

Therefore, $\left(\frac{c}{4}\right)_w = 2c - 2\left(\frac{c}{4}\right)_r$, rejecting sevens,

Similarly, $\left(\frac{y}{4}\right)_w = 2y - 2\left(\frac{y}{4}\right)_r$,, ,,

Hence, by substitution, the advancement of the day of the week, or the number by which the dominical letter has retrograded, is

$$L_0 - L = 126c + 3y - 2\left(\frac{c}{4}\right)_r - 2\left(\frac{y}{4}\right)_r, \text{ rejecting sevens,}$$

$$= * \; 3y - 2\left(\frac{c}{4}\right)_r - 2\left(\frac{y}{4}\right)_r \quad \text{,,} \quad \text{,,}$$

The value of the sought number L is therefore

$$L=2\left(\frac{c}{4}\right)_r+2\left(\frac{y}{4}\right)_r-3y+L_0 \text{ rejecting sevens}$$

$$=2\left(\frac{c}{4}\right)_r+2\left(\frac{y}{4}\right)_r+4y+L_0 \quad \text{,,} \quad \text{,,}$$

$$=2\left(\frac{c}{4}\right)_r+2\left(\frac{y}{4}\right)_r+4\left(\frac{y}{7}\right)_r+L_0 \quad \text{,,} \quad \text{,,}$$

It will be observed that sevens are rejected in this investigation because they do not alter the day of the week, and that sevens may be added to negative numbers for a like reason.

The letter L denotes the number that indicates the ordinal position in which the dominical letter stands in the alphabet. Similarly L_0 denotes the corresponding ordinal number for the year 0. Thus L_0-L determines how much the dominical number or dominical letter has retrograded through the entire period, that is, after sevens have been freely rejected from the result.

The number L_0 refers to a given year, and is, therefore, a constant. It will be requisite to ascertain its value in order to finally adapt the foregoing formula to direct calculation. Before proceeding to do so it may be well to observe by way of explanation of the object attained by the preceding deductions, that the terms of the expression have been severally put in the form of remainders, so as to simplify the computation as much as possible by the exclusive use of very small numbers.

By testing the last expression with any given year for which L is known, it is found that the constant $L_0=1$. Therefore the dominical letter for any year, $Y=100c+y$, in the Gregorian Calendar may always be found from the simple and general formula,

$$L=2\left(\frac{c}{4}\right)_r+2\left(\frac{y}{4}\right)_r+4\left(\frac{y}{7}\right)_r+1 \text{ (rejecting sevens);}$$

where the small letter r is placed to indicate that it is the *remainder* of each division that enters into the calculation. The resulting number L may be called the *dominical number*, as it will indicate the numerical order of the required letter.

Thus if L be	1	2	3	4	5	6	7
The letter will be	A	B	C	D	E	F	G

If the proposed year be bissextile, the letter so calculated will be the second letter of the year, or that which applies after the intercalary day in February.

The preceding formula may be put down in the following rule:—

Rule.—Divide the number of centuries by 4; the years of the current century by 4, and the same by 7: put down the three remainders; multiply them respectively by 2, 2, 4; add together the three products with an additional unit, and the sum after rejecting sevens, if necessary, will be the dominical number, or the ordinal number in which the dominical letter stands in the alphabet.

Example.—Required the dominical letter for the year 1942. The centuries are here 19, and the years of the current century 42; the three remainders are therefore 3, 2, 0; the three products are 6, 4, 0; which added together with an additional unit give 11; therefore rejecting 7, the ordinal number of the required letter is 4; it is therefore D, the fourth letter of the alphabet.

The dominical letter or letters of any proposed year may be obtained, by inspection, from the following table, to which an auxiliary table is added, showing the means by which the dominical letter is made to indicate the day of the week answering to any given date.

PERPETUAL TABLE OF DOMINICAL LETTERS.

Year of the Current Century (y).				Completed Centuries (c).			
				$\left(\frac{c}{4}\right)_r = 1$	$\left(\frac{c}{4}\right)_r = 2$	$\left(\frac{c}{4}\right)_r = 3$	$\left(\frac{c}{4}\right)_r = 0$
				1700	1800	1900	2000
				2100	2200	2300	2400
				&c.	&c.	&c.	&c.
0				C	E	G	BA
1	29	57	85	B	D	F	G
2	30	58	86	A	C	E	F
3	31	59	87	G	B	D	E
4	32	60	88	FE	AG	CB	DC
5	33	61	89	D	F	A	B
6	34	62	90	C	E	G	A
7	35	63	91	B	D	F	G
8	36	64	92	AG	CB	ED	FE
9	37	65	93	F	A	C	D
10	38	66	94	E	G	B	C
11	39	67	95	D	F	A	B
12	40	68	96	CB	ED	GF	AG
13	41	69	97	A	C	E	F
14	42	70	98	G	B	D	E
15	43	71	99	F	A	C	D
16	44	72		ED	GF	BA	CB
17	45	73		C	E	G	A
18	46	74		B	D	F	G
19	47	75		A	C	E	F
20	48	76		GF	BA	DC	ED
21	49	77		E	G	B	C
22	50	78		D	F	A	B
23	51	79		C	E	G	A
24	52	80		BA	DC	FE	GF
25	53	81		G	B	D	E
26	54	82		F	A	C	D
27	55	83		E	G	B	C
28	56	84		DC	FE	AG	BA

TABLE SHOWING THE DAY OF THE WEEK.

Month.					Dominical Letter.						
Jan. Oct.					A	B	C	D	E	F	G
Feb. Mar. Nov.					D	E	F	G	A	B	C
Apr. July					G	A	B	C	D	E	F
May					B	C	D	E	F	G	A
June					E	F	G	A	B	C	D
August					C	D	E	F	G	A	B
Sept. Dec.					F	G	A	B	C	D	E
1	8	15	22	29	Sun.	Sat.	Frid.	Thur.	Wed.	Tues.	Mon.
2	9	16	23	30	Mon.	Sun.	Sat.	Frid.	Thur.	Wed.	Tues.
3	10	17	24	31	Tues.	Mon.	Sun.	Sat.	Frid.	Thur.	Wed.
4	11	18	25		Wed.	Tues.	Mon.	Sun.	Sat.	Frid.	Thur.
5	12	19	26		Thur.	Wed.	Tues.	Mon.	Sun.	Sat.	Frid.
6	13	20	27		Frid.	Thur.	Wed.	Tues.	Mon.	Sun.	Sat.
7	14	21	28		Sat.	Frid.	Thur.	Wed.	Tues.	Mon.	Sun.

Cycle of the Sun.—As the number of dominical letters, or days in the week, is seven, and as every fourth year is bissextile or leap-year, the same order of dominical letters for a specified year of the Julian Calendar only returns after 4 times 7, or 28 years, which is the period of the solar cycle. The cycle is considered as having commenced nine years before the era, so that the number or year of the cycle corresponding to any year Y of the Julian Calendar, is determined by the formula,

$$s = \left(\frac{Y+9}{28}\right)_r,$$

which may be stated in the following rule:—

Rule.—Add 9 to the given year; divide the sum by 28;

the quotient is the number of cycles elapsed, and the remainder is the number or year of the cycle: if there be no remainder, the number is 28, the last of the current cycle.

If preferred, the calculation may be modified thus:—

Second Rule.—Having, as before, added 9 to the year, divide by 4, and the integral quotient again by 7; then the first remainder added to 4 times the second remainder will give the number of the solar cycle. If there be no remainder to either division, the required number is 28.

Example.—Required the number of the solar cycle for the year 1942.

The year, augmented by 9, is 1951.

1951, divided by 4, gives 487, with first remainder 3;

487 „ 7 „ 69 „ second „ 4;

and adding 3 to 4 times 4, the number of the solar cycle is 19.

Otherwise the solar cycle may perhaps most conveniently be deduced by subtracting from the given year the next less number contained in the following formula:—

Cycle (s) = year − (1811, 1839, 1867, 1895, 1923, 1951, 1979, 2007, 2035, 2063, 2091, &c.).

The cycle of the sun, or more properly the *Sunday cycle*, was invented for the purpose of determining the dominical letter or letters for any given year of the Julian Calendar, by means of a short and convenient table exhibiting the same for each of the 28 years of one cycle.

But according to the Gregorian Calendar now in general use in every Christian country, with the exception of Russia, the order of the letters is necessarily interrupted by the first suppression of a centenary leap-year, and the table of dominical letters must therefore, after every such year, be reconstructed for the next following century. We have, however, found, page 140, that the complete intercalary period of 400 Gregorian years consists of 146,097 days.

As this number is divisible by 7 without a remainder, and therefore comprises exactly 20,871 weeks, it follows that the same order of dominical letters and days of the week will recur after this period of 400 years, which is therefore the complete Sunday cycle of the Gregorian Calendar. The purport of these remarks may perhaps receive further elucidation from an examination of the perpetual table of dominical letters already given, which extends through a complete cycle of 400 years, and will therefore in future calculations supersede the use of the solar cycle.

Golden Number. — The cycle of the moon or lunar cycle, sometimes called the Metonic cycle, after the name of its original inventor, Meton, is a period of *nineteen* years, after which the new moons fall on the same days of the Julian year, within an hour and a half. The number which any given year occupies in the current cycle was called the *golden number*, from the circumstance of its being usually marked in letters of gold in ancient calendars, and it was used for the purpose of determining the days of new moon, and of thereby fixing the date of Easter-day, on which the other moveable feasts of the ecclesiastical calendar are made to depend. The year of the birth of our Saviour is reckoned the first of the lunar cycle, and therefore the golden number for any year Y is determined by the formula,

$$g = \left(\frac{Y+1}{19}\right)_r$$

which may be expressed by the following rule:—

Rule.—Add 1 to the year; divide the sum by 19; the quotient is the number of completed cycles, and the remainder is the golden number. If 0 remains, the number is 19, the year being in that case the 19th or last of the cycle.

By this rule the following table has been calculated, and the golden number for any proposed year can be taken from it by inspection.

PERPETUAL TABLE OF

Year of the Century.						Centuries.								
						0	100	200	300	400	500	600	700	800
						1900	2000	2100	2200	2300	2400	2500	2600	2700
						3800	3900	4000	4100	4200	4300	4400	4500	4600
						5700	5800	5900	6000	6100	6200	6300	6400	6500
						7600	7700	7800	7900	8000	8100	8200	8300	8400
						Golden Number (g).								
0	19	38	57	76	95	1	6	11	16	2	7	12	17	3
1	20	39	58	77	96	2	7	12	17	3	8	13	18	4
2	21	40	59	78	97	3	8	13	18	4	9	14	19	5
3	22	41	60	79	98	4	9	14	19	5	10	15	1	6
4	23	42	61	80	99	5	10	15	1	6	11	16	2	7
5	24	43	62	81		6	11	16	2	7	12	17	3	8
6	25	44	63	82		7	12	17	3	8	13	18	4	9
7	26	45	64	83		8	13	18	4	9	14	19	5	10
8	27	46	65	84		9	14	19	5	10	15	1	6	11
9	28	47	66	85		10	15	1	6	11	16	2	7	12
10	29	48	67	86		11	16	2	7	12	17	3	8	13
11	30	49	68	87		12	17	3	8	13	18	4	9	14
12	31	50	69	88		13	18	4	9	14	19	5	10	15
13	32	51	70	89		14	19	5	10	15	1	6	11	16
14	33	52	71	90		15	1	6	11	16	2	7	12	17
15	34	53	72	91		16	2	7	12	17	3	8	13	18
16	35	54	73	92		17	3	8	13	18	4	9	14	19
17	36	55	74	93		18	4	9	14	19	5	10	15	1
18	37	56	75	94		19	5	10	15	1	6	11	16	2

As the lunar months in the construction of the calendar must necessarily be estimated in integral days, and as the mean value of the lunar synodical month is over 29½ days, it is evident that the calendar lunations must consist mainly of 30 and 29 days alternately, but that on the whole there should be rather more of the former than the latter. Now 19 ordinary years of 365 days make 6935 days; these are distributed into 235 calendar lunations in the following manner.

The lunations are made to consist of 30 and 29 days alternately, so that each lunar year of 12 lunations thus

GOLDEN NUMBERS.

Year of the Century.	Centuries.									
	900	1000	1100	1200	1300	1400	1500	1600	1700	1800
	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700
	4700	4800	4900	5000	5100	5200	5300	5400	5500	5600
	6600	6700	6800	6900	7000	7100	7200	7300	7400	7500
	8500	8600	8700	8800	8900	9000	9100	9200	&c.	&c.
	Golden Number (*g*).									
0 19 38 57 76 95	8	13	18	4	9	14	19	5	10	15
1 20 39 58 77 96	9	14	19	5	10	15	1	6	11	16
2 21 40 59 78 97	10	15	1	6	11	16	2	7	12	17
3 22 41 60 79 98	11	16	2	7	12	17	3	8	13	18
4 23 42 61 80 99	12	17	3	8	13	18	4	9	14	19
5 24 43 62 81	13	18	4	9	14	19	5	10	15	1
6 25 44 63 82	14	19	5	10	15	1	6	11	16	2
7 26 45 64 83	15	1	6	11	16	2	7	12	17	3
8 27 46 65 84	16	2	7	12	17	3	8	13	18	4
9 28 47 66 85	17	3	8	13	18	4	9	14	19	5
10 29 48 67 86	18	4	9	14	19	5	10	15	1	6
11 30 49 68 87	19	5	10	15	1	6	11	16	2	7
12 31 50 69 88	1	6	11	16	2	7	12	17	3	8
13 32 51 70 89	2	7	12	17	3	8	13	18	4	9
14 33 52 71 90	3	8	13	18	4	9	14	19	5	10
15 34 53 72 91	4	9	14	19	5	10	15	1	6	11
16 35 54 73 92	5	10	15	1	6	11	16	2	7	12
17 36 55 74 93	6	11	16	2	7	12	17	3	8	13
18 37 56 75 94	7	12	17	3	8	13	18	4	9	14

comprises 354 days, which is 11 days short of the ordinary calendar year of 365 days. To correct this accumulating deficiency, 6 embolismic months of 30 days each are introduced in the course of the cycle of 19 years, and one of 29 days is added at the termination of the cycle. In this way the 235 lunations become divided thus:

120	calendar lunations of	30 days	= 3600 days
115	„	„	29 „	= 3335 „
235	„	„	30 and 29 „	= 6935 days.

Furthermore, in every bissextile year the intercalary day is also added to the days of the lunation in which it happens to be included, making the same 30 instead of 29 days, so that the 235 lunations thus distributed will then accurately measure 19 Julian years. Thus, as the intercalary day of the Julian Calendar occurs uniformly once in every four years without interruption, the average number of such days, distributed in periods of 19 years, will be $4\frac{3}{4}$ days, which, added to the 6935 days, give $6939\frac{3}{4}$ days for the mean value of the entire cycle so formed, and this is exactly equal to 19 mean Julian years of $365\frac{1}{4}$ days.

There are two objections, in point of accuracy, to the permanency of this lunar-solar period. In the first place, the Julian year, employed as the basis of calculation, does not correctly represent either the mean solar or the Gregorian year; as compared with the latter, the accumulated error after any stated epoch will be represented by the augmentation of the requisite correction for reducing the old to the new style. In the second place, the period of $6939\frac{3}{4}$ days is nearly an hour and a half in excess of 235 mean astronomical lunations, and therefore the correct time of new moon will in successive cycles happen so much earlier, and will retrograde a day in every 308 years. For the purpose of correcting and adjusting the errors whenever they amount to one day, by an established system of calculation, Lilius introduced another set of numbers called Epacts.

Epact.—The epact for any year is a number designed to represent the age of the moon on the first day, that is, on the 1st day of January, of that year.

Suppose, for the first year of a lunar cycle, a new moon to happen on the 1st day of January; then the age on the day of new moon being 0, the epact for that year will be 0. Now the civil year containing 365 days, and the lunar year only 354 days, the new moon will at the end of the year have retrograded 11 days, and this will be the same if the civil

year be a bissextile of 366 days, because in that case the intercalary day is also included in the lunations, causing the lunar year to consist of 355 days. It therefore follows that the moon's age on the 1st of January of the second year of the cycle, or the epact of the second year, will be 11 days. Similarly the epact for the third year will be 22 days. Another addition of 11 would give 33 for the fourth year; but in consequence of the insertion of the embolismic month of 30 days, the epact for the fourth year is reduced to 3. In like manner the epacts of the following years are deduced by successively adding 11 and rejecting 30 whenever the sum exceeds that number, excepting at the termination of the cycle, where the last embolismic month being only 29 days, the same number is deducted, and we again have 0 for the epact of the first year of the next cycle. The order of the epacts throughout each cycle is therefore as follows:—

Year of the Cycle, or Golden Number (g).																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
*	11	22	3	14	25	6	17	28	9	20	1	12	23	4	15	26	7	18
Epact (ϵ).																		

This table will exhibit the epacts correctly from the year 1700 to the year 1900, the mathematical relations being,

$$g = \left(\frac{Y+1}{19}\right)_r, \qquad \epsilon = \left(\frac{11\,(g-1)}{30}\right)_r.$$

But it has been explained under the article *Golden Number*, that in the course of centuries the astronomical new moon will deviate from the preceding deductions, from two causes, viz. the small error of the cycle of 235 calendar lunations as compared with 235 mean astronomical lunations, and the gradual shifting of dates on account of the difference between the Julian and Gregorian styles. We now proceed to in-

vestigate the principles on which these irregularities are calculated and adjusted.

To determine the error on account of the inaccurate measure of the lunations, we have

19 mean Julian years, each 365·25 days	. .	6939·75 days
235 astronomical lunations, each 29·5305887 days		6939·68834 „
		0·06166 day.

The excess of the established period of the lunar cycle or the Julian Calendar over the astronomical lunations is therefore 0·06166 day, or about 1 h. 28·8 min. Thus after every cycle of 19 years the times of new moon will happen 1 h. 28·8 min. earlier than in the preceding cycle, and therefore the age of the moon will become periodically *increased* by the same quantity, which will amount to a day in about 308 years. In the construction of the calendar it has been assumed to amount to 8 days in 25 centuries, and, when computed from the year 1700, to be determined by the formula,

$$a = \left(\frac{c-17}{25}\right)_w, \quad \text{correction} = \left(\frac{c-a}{3}\right)_w - 5.$$

Thus after a period of 25 centuries,

c will be augmented by 25,
a „ „ „ 1,
$c-a$ „ „ „ 24;

therefore the correction $\left(\frac{c-a}{3}\right)_w - 5$ will give exactly 8 days in every 25 centuries, and this reduces the lunar error to less than a day in 270,000 years.

To obtain the correction on account of difference of style, if c, as before, denote the number of completed centuries in the proposed year Y, we have ascertained that the number of days' difference between the old and new styles will then

have amounted to $c - \left(\frac{c}{4}\right)_w - 2$. When $c = 17$ it is 11 days for the year 1700; therefore, from 1700 to the given year Y, the divergence on account of style will be $c - \left(\frac{c}{4}\right)_w - 13$, and the age of the moon or epact for the year will thereby be *diminished* by the number of days represented by this last formula, which expresses, in fact, the number of centenary years passed over that are not made bissextile.

For the complete correction of the epact or moon's age, it will hence be requisite to add $\left(\frac{c-a}{3}\right)_w - 5$, and to subtract $c - \left(\frac{c}{4}\right)_w - 13$, or to apply the difference of these corrections, viz. $8 + \left(\frac{c}{4}\right)_w + \left(\frac{c-a}{3}\right)_w - c$. Thus in the new style or Gregorian Calendar, the general formulæ for determining the epact for any year Y are

$$a = \left(\frac{c-17}{25}\right)_w$$

$$e = \epsilon + 8 + \left(\frac{c}{4}\right)_w + \left(\frac{c-a}{3}\right)_w - c$$

$$= \left(\frac{11\,(g-1)}{30}\right)_r + 8 + \left(\frac{c}{4}\right)_w + \left(\frac{c-a}{3}\right)_w - c.$$

Should the calculation of this expression come out negative, an embolismic month of 30 days must be added.

Note.—Should the result be $\frac{24}{25}$, change it into $\frac{25}{26}$ whenever the golden number exceeds 11.

Example.—Required the epact for the year 1942.

Here $Y = 1942$ and $c = 19$.

$Y + 1 = 1942 + 1 = 1943$, which on being divided by 19 leaves as remainder the golden number $g = 5$.

$11\,(g-1) = 11 \times 4 = 44$, which divided by 30 leaves as remainder $\epsilon = 14$.

$c - 17 = 2$, which divided by 25, the whole number of the quotient is $a = 0$: (this will always be 0 until the year 4200.)

Therefore the required epact $= \epsilon + 8 + \left(\frac{c}{4}\right)_w + \left(\frac{c-a}{3}\right)_w - c = 14 + 8 + 4 + 6 - 19 = 13.$

By first taking out the golden number from the table, page 158, the epact for any given year may be obtained by inspection from the following table, in the column under the completed centuries.

TABLE OF EPACTS.

Golden Number (g).	Last Comp'eted Century (c).										
	1500 1600	1700 1800	1900 2000 2100	2200 2400	2300 2500	2600 2700 2800	2900 3000	3100 3200 3300	3400 3600	3500 3700	3800 3900 4000
1	1	*	29	28	27	26	25	24	23	22	21
2	12	11	10	9	8	7	6	5	4	3	2
3	23	22	21	20	19	18	17	16	15	14	13
4	4	3	2	1	*	29	28	27	26	25	24
5	15	14	13	12	11	10	9	8	7	6	5
6	26	25	24	23	22	21	20	19	18	17	16
7	7	6	5	4	3	2	1	*	29	28	27
8	18	17	16	15	14	13	12	11	10	9	8
9	29	28	27	26	25	24	23	22	21	20	19
10	10	9	8	7	6	5	4	3	2	1	*
11	21	20	19	18	17	16	15	14	13	12	11
12	2	1	*	29	28	27	26	25	24	23	22
13	13	12	11	10	9	8	7	6	5	4	3
14	24	23	22	21	20	19	18	17	16	15	14
15	5	4	3	2	1	*	29	28	27	26	25
16	16	15	14	13	12	11	10	9	8	7	6
17	27	26	25	24	23	22	21	20	19	18	17
18	8	7	6	5	4	3	2	1	*	29	28
19	19	18	17	16	15	14	13	12	11	10	9

NUMBER OF DIRECTION.—The number of direction is the number of days that Easter-day falls later than the 21st of March. Easter, as ordained by the Council of Nice, is the first Sunday after the first full moon which happens upon or

next after the 21st day of March; and if the full moon happens on a Sunday, then Easter-day is the Sunday after. This last condition was introduced to avoid the celebration of Easter at the same time as the Jewish Passover; notwithstanding which, this coincidence will sometimes happen, and will next occur in the year 1903. The moon on which Easter immediately depends is called the *paschal moon*, and the full moon is defined to be the 14th day of the moon, that is, 13 days after the preceding day of new moon.

Now the epact, e, is the age of the moon on January 1; and therefore January $(31 - e)$ is a day of new moon. And as the months January and February together comprise the same number of days as two alternate lunations of 29 and 30 days, it follows that March $(31 - e)$ must likewise be a day of new moon. Adding 13 days, the 14th day of this moon will fall on March $(44 - e)$, and this will be upon or later than the 21st day of March, and therefore be the paschal full moon, provided e be less than 24. When e is 24 or greater than 24 the next following moon will be the paschal moon, and the date so found will require to be increased by 29 or 30 days respectively as the period of the current lunation. The reason of this distinction is, that the epacts 24 and 25 are made to occupy the same day in the calendar whenever the lunation is required to pass from 29 to 30 days, which is the case in April. The number of days from March 21 to the day of the paschal full moon, which for uniformity we shall designate the *Paschal Direction* and denote by P, is therefore thus determined:—

$$\begin{aligned} &\text{When } e < 24,\ P = 23 - e; \\ &\text{„ } \quad e = 24,\ P = 28; \\ &\text{„ } \quad e > 24,\ P = 53 - e. \end{aligned}$$

Next, to find the Sunday following the paschal full moon, if L denote the dominical number, $L + 4 + 7m$ days after March 21 will be a Sunday, and the number of days which intervene between the day of the paschal full moon and this

Sunday will be $L + 3 + 7m - P$. Therefore the number of days which intervene between the paschal full moon and the immediately following Sunday, or Easter, will be the least positive remainder of $L + 3 + 7m - P$ when divided by 7; and, denoting these intervening days by p,

when $P = 23 - e$, $p = \left(\frac{L + e + 7m - 20}{7}\right)_r = \left(\frac{L + e + 1}{7}\right)_r$

„ $P = 28$, $p = \left(\frac{L + 3}{7}\right)_r$

„ $P = 53 - e$, $p = \left(\frac{L + e + 7m - 50}{7}\right)_r = \left(\frac{L + e - 1}{7}\right)_r$.

Hence if N be the number of direction, $N = P + 1 + p$, and we obtain the following general formulæ for its computation :—

When $e < 24$, $N = 24 - e + \left(\frac{L + e + 1}{7}\right)_r$

„ $e = 24$, $N = 29 + \left(\frac{L + 3}{7}\right)_r$

„ $e > 24$, $N = 54 - e + \left(\frac{L + e - 1}{7}\right)_r$.

Example.—Find by calculation the number of direction for the year 1942.

The dominical number, page 153, has been found to be $L = 4$; and, page 164, the epact to be $e = 13$

Therefore, e being less than 24,

$$N = 24 - e + \left(\frac{L + e + 1}{7}\right)_r$$

$$= 24 - 13 + \left(\frac{4 + 13 + 1}{7}\right)_r$$

$$= 11 + \left(\frac{18}{7}\right)_r = 11 + 4 = 15.$$

This calculation however may in all cases be dispensed with by entering the following table with the epact and dominical letter.

Perpetual Table for finding the NUMBER OF DIRECTION (*N*) *from the Epact and Dominical Letter.*

(For Leap Years use the *second* letter.)

Epact (*e*).	Dominical Letter.						
	A	B	C	D	E	F	G
*	26	27	28	29	30	24	25
1	26	27	28	29	23	24	25
2	26	27	28	22	23	24	25
3	26	27	21	22	23	24	25
4	26	20	21	22	23	24	25
5	19	20	21	22	23	24	25
6	19	20	21	22	23	24	18
7	19	20	21	22	23	17	18
8	19	20	21	22	16	17	18
9	19	20	21	15	16	17	18
10	19	20	14	15	16	17	18
11	19	13	14	15	16	17	18
12	12	13	14	15	16	17	18
13	12	13	14	15	16	17	11
14	12	13	14	15	16	10	11
15	12	13	14	15	9	10	11
16	12	13	14	8	9	10	11
17	12	13	7	8	9	10	11
18	12	6	7	8	9	10	11
19	5	6	7	8	9	10	11
20	5	6	7	8	9	10	4
21	5	6	7	8	9	3	4
22	5	6	7	8	2	3	4
23	5	6	7	1	2	3	4
24	33	34	35	29	30	31	32
25	33	34	35	29	30	31	32
26	33	34	28	29	30	31	32
27	33	27	28	29	30	31	32
28	26	27	28	29	30	31	32
29	26	27	28	29	30	31	25

EASTER-DAY.—The date of Easter-day is obtained by simply adding the number of direction to March 21. It is therefore March ($N + 21$), or April ($N - 10$); and by

employing the foregoing values of N we deduce the following formulæ for its determination:—

When $e < 24$, Easter is $\left\{\begin{matrix}\text{March}\,(45-e)\\ \text{April}\;\;(14-e)\end{matrix}\right\} + \left(\frac{L+e+1}{7}\right)_r$

„ $e = 24$, „ „ April 19 $+ \left(\frac{L+3}{7}\right)_r$

„ $e > 24$ „ „ April $(44-e) + \left(\frac{L+e-1}{7}\right)_r$.

By entering the following table with the epact and the dominical letter the date of Easter-day may always be ascertained by inspection.

Perpetual Table for determining EASTER-DAY *from the Epact and Dominical Letter.*

Epact (*e*).	Dominical letter. (For Leap Years use the *second* letter.)						
	A	B	C	D	E	F	G
*	Apr. 16	Apr. 17	Apr. 18	Apr. 19	Apr. 20	Apr. 14	Apr. 15
1	„ 16	„ 17	„ 18	„ 19	„ 13	„ 14	„ 15
2	„ 16	„ 17	„ 18	„ 12	„ 13	„ 14	„ 15
3	„ 16	„ 17	„ 11	„ 12	„ 13	„ 14	„ 15
4	„ 16	„ 10	„ 11	„ 12	„ 13	„ 14	„ 15
5	„ 9	„ 10	„ 11	„ 12	„ 13	„ 14	„ 15
6	„ 9	„ 10	„ 11	„ 12	„ 13	„ 14	„ 8
7	„ 9	„ 10	„ 11	„ 12	„ 13	„ 7	„ 8
8	„ 9	„ 10	„ 11	„ 12	„ 6	„ 7	„ 8
9	„ 9	„ 10	„ 11	„ 5	„ 6	„ 7	„ 8
10	„ 9	„ 10	„ 4	„ 5	„ 6	„ 7	„ 8
11	„ 9	„ 3	„ 4	„ 5	„ 6	„ 7	„ 8
12	„ 2	„ 3	„ 4	„ 5	„ 6	„ 7	„ 8
13	„ 2	„ 3	„ 4	„ 5	„ 6	„ 7	„ 1
14	„ 2	„ 3	„ 4	„ 5	„ 6	Mar. 31	„ 1
15	„ 2	„ 3	„ 4	„ 5	Mar. 30	„ 31	„ 1
16	„ 2	„ 3	„ 4	Mar. 29	„ 30	„ 31	„ 1
17	„ 2	„ 3	Mar. 28	„ 29	„ 30	„ 31	„ 1
18	„ 2	Mar. 27	„ 28	„ 29	„ 30	„ 31	„ 1
19	Mar. 26	„ 27	„ 28	„ 29	„ 30	„ 31	„ 1
20	„ 26	„ 27	„ 28	„ 29	„ 30	„ 31	Mar. 25
21	„ 26	„ 27	„ 28	„ 29	„ 30	„ 24	„ 25
22	„ 26	„ 27	„ 28	„ 29	„ 23	„ 24	„ 25
23	„ 26	„ 27	„ 28	„ 22	„ 23	„ 24	„ 25
24	Apr. 23	Apr. 24	Apr. 25	Apr. 19	Apr. 20	Apr. 21	Apr. 22
25	„ 23	„ 24	„ 25	„ 19	„ 20	„ 21	„ 22
26	„ 23	„ 24	„ 18	„ 19	„ 20	„ 21	„ 22
27	„ 23	„ 17	„ 18	„ 19	„ 20	„ 21	„ 22
28	„ 16	„ 17	„ 18	„ 19	„ 20	„ 21	„ 22
29	„ 16	„ 17	„ 18	„ 19	„ 20	„ 21	„ 15

INDICTION.—The Roman Indiction is a mode of measuring time by a cycle of 15 years, formerly used by the Romans for some time after the Emperor Constantine, but the precise time of its first adoption has not been ascertained with certainty, beyond the fact that the year 313 of the Christian era was a first year of a cycle of indiction.

To find the indiction, we must therefore observe the following rule :—

Rule.—Add 3 to the year ; divide the sum by 15, and the remainder will be the Indiction. If there be no remainder, the Indiction is 15. Or divide the sum by 30, and diminish the remainder by 15 if greater than 15.

DIONYSIAN PERIOD.—The Dionysian is a period of 532 years, formed from the product of the lunar cycle 19 and the solar cycle 28, and invented by Dionysius Exiguus about the time of the Council of Nice, to include all the varieties of the new moons and dominical letters ; so that after every 532 years they were expected to recur in the same order. This would have been very convenient for fixing the date of Easter and of the other days of the calendar by a table calculated for the years of one cycle ; but as the measure of the lunar cycle was supposed to be exact, which is not the case, and as the Sunday cycle is now interrupted at the centenary years that are not bissextile, the Dionysian period is no longer used in such calculations.

To find the year of the Dionysian Period :—

Rule.—Add 457 to the year of Christ ; divide the sum by 532, and the remainder will be the number required. Or for any year, from the present time up to the year 2203,

$$\text{Year of the Dionysian} = 129 + (\text{Year} - 1800),$$
$$\text{or} = \text{Year} - (1671, 2128, \&c.).$$

When divided by 28 the remainder is the solar cycle ; when divided by 19 the remainder is the lunar cycle or golden number.

JULIAN PERIOD.—The Julian Period is a large cycle of 7980 years, formed by multiplying together the lunar cycle of 19 years, the solar cycle of 28, and the indiction of 15, and its commencement goes back 4714 years beyond the Christian era.

To determine the number for any year.

Rule.—Add 4713 to the given year; divide the sum by 7980; the remainder will be the year of the Julian Period. Or for any year from the present time up to the year 3267,

$$\text{Year of the Julian Period} = 6513 + (\text{Year} - 1800).$$

If the year of the Julian Period be divided by 19, the remainder will be the *golden number;* if it be divided by 28, the remainder will be the *solar cycle;* and if it be divided by 15, the remainder will be the *indiction* for the corresponding year. Also, if it be divided by 532, the remainder will be the year of the Dionysian.

MOON'S AGE.—The age of the moon on any given date may be approximately deduced by adding to the epact the day of the month and the number below for the month, rejecting 30's if necessary.

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
0	1	0	1	2	3	4	5	7	7	9	9

MOVEABLE FEASTS.—These are in general made to depend on the date of Easter-day. The following are some of the principal Sundays:—

Septuagesima Sunday	is	9	weeks before Easter.
Shrove Sunday	„	7	
1 Sunday in Lent	„	6	
Midlent Sunday	„	3	
Rogation Sunday	is	5	weeks after Easter.
Whit-Sunday	„	7	
Trinity Sunday	„	8	

Advent Sunday is the nearest Sunday to November 30, whether before or after.

Also,

First day of Lent is 3 days after Shrove Sunday.
Good Friday „ 2 „ before Easter.
Ascension-day „ 4 „ after Rogation Sunday.

The number of days which *intervene* between Epiphany (January 6) and Septuagesima Sunday is $10 + N$ in ordinary years, and $11 + N$ in bissextile years, N denoting the number of direction. Therefore, as the Epiphany Sundays are included in this interval,

$$\text{Sundays after Epiphany} = \left(\frac{10 + N}{7}\right)_w \text{ in ordinary years}$$

$$\text{„ \quad „ \quad „} = \left(\frac{11 + N}{7}\right)_w \text{ „ bissextile „}$$

Also the number of days *intervening* between Trinity Sunday and November 27, the earliest possible date of Advent Sunday, $= 194 - N$. Therefore,

$$\text{Sundays after Trinity} = \left(\frac{194 - N}{7}\right)_w$$

$$= 22 + \left(\frac{40 - N}{7}\right)_w.$$

To determine the elements of the Christian calendar, for any given year, it is only requisite to take out, by inspection,

the Dominical Letter	from the table, page			154
„ Golden Number	„	„	„	158
„ Epact	„	„	„	164
„ Number of Direction	„	„	„	167

When the number of direction has thus been ascertained, the moveable feasts and other articles of the calendar will be shown by the following tables.

Table of the MOVEABLE FEASTS, *&c., according to the Number of Direction.*

Number of Direction (*N.*)	Dominical Letter.	Sundays after Epiphany.	Septuagesima Sunday.	Shrove Sunday.	First Day of Lent.	1 Sunday in Lent.	Midlent Sunday.
1	D, ED	1	Jan. 18, 19	Feb. 1, 2	Feb. 4, 5	Feb. 8, 9	Mar. 1
2	E, FE	1	,, 19, 20	,, 2, 3	,, 5, 6	,, 9, 10	,, 2
3	F, GF	1, 2	,, 20, 21	,, 3, 4	,, 6, 7	,, 10, 11	,, 3
4	G, AG	2	,, 21, 22	,, 4, 5	,, 7, 8	,, 11, 12	,, 4
5	A, BA	2	,, 22, 23	,, 5, 6	,, 8, 9	,, 12, 13	,, 5
6	B, CB	2	,, 23, 24	,, 6 7	,, 9, 10	,, 13, 14	,, 6
7	C, DC	2	,, 24, 25	,, 7, 8	,, 10, 11	,, 14, 15	,, 7
8	D, ED	2	,, 25, 26	,, 8, 9	,, 11, 12	,, 15, 16	,, 8
9	E, FE	2	,, 26, 27	,, 9, 10	,, 12, 13	,, 16, 17	,, 9
10	F, GF	2, 3	,, 27, 28	,, 10, 11	,, 13, 14	,, 17, 18	,, 10
11	G, AG	3	,, 28, 29	,, 11, 12	,, 14, 15	,, 18, 19	,, 11
12	A, BA	3	,, 29, 30	,, 12, 13	,, 15, 16	,, 19, 20	,, 12
13	B, CB	3	,, 30, 31	,, 13, 14	,, 16, 17	,, 20, 21	,, 13
14	C, DC	3	,, 31, F1	,, 14, 15	,, 17, 18	,, 21, 22	,, 14
15	D, ED	3	Feb. 1, 2	,, 15, 16	,, 18, 19	,, 22, 23	,, 15
16	E, FE	3	,, 2, 3	,, 16, 17	,, 19, 20	,, 23, 24	,, 16
17	F, GF	3, 4	,, 3, 4	,, 17, 18	,, 20, 21	,, 24, 25	,, 17
18	G, AG	4	,, 4, 5	,, 18, 19	,, 21, 22	,, 25, 26	,, 18
19	A, BA	4	,, 5, 6	,, 19, 20	,, 22, 23	,, 26, 27	,, 19
20	B, CB	4	,, 6, 7	,, 20, 21	,, 23, 24	,, 27, 28	,, 20
21	C, DC	4	,, 7, 8	,, 21, 22	,, 24, 25	,, 28, 29	,, 21
22	D, ED	4	,, 8, 9	,, 22, 23	,, 25, 26	Mar. 1	,, 22
23	E, FE	4	,, 9, 10	,, 23, 24	,, 26, 27	,, 2	,, 23
24	F, GF	4, 5	,, 10, 11	,, 24, 25	,, 27, 28	,, 3	,, 24
25	G, AG	5	,, 11, 12	,, 25, 26	,, 28, 29	,, 4	,, 25
26	A, BA	5	,, 12, 13	,, 26, 27	Mar. 1	,, 5	,, 26
27	B, CB	5	,, 13, 14	,, 27, 28	,, 2	,, 6	,, 27
28	C, DC	5	,, 14, 15	,, 28, 29	,, 3	,, 7	,, 28
29	D, ED	5	,, 15, 16	Mar. 1	,, 4	,, 8	,, 29
30	E, FE	5	,, 16, 17	,, 2	,, 5	,, 9	,, 30
31	F, GF	5, 6	,, 17, 18	,, 3	,, 6	,, 10	,, 31
32	G, AG	6	,, 18, 19	,, 4	,, 7	,, 11	Apr. 1
33	A, BA	6	,, 19, 20	,, 5	,, 8	,, 12	,, 2
34	B, CB	6	,, 20, 21	,, 6	,, 9	,, 13	,, 3
35	C, DC	6	,, 21, 22	,, 7	,, 10	,, 14	,, 4

*** Second entries in the above table are for bissextile years.

LAW TERMS.—The Law Terms and Returns were formerly regulated by statute 1 William IV. cap. 70, passed the 22nd of July,

Table (continued) of the MOVEABLE FEASTS, *&c.*

Good Friday.	Easter Day.	Rogation Sunday.	Ascension.	Whit-Sunday.	Trinity Sunday.	Sundays after Trinity.	Advent Sunday.
Mar. 20	Mar. 22	Apr. 26	Apr. 30	May 10	May 17	27	Nov. 29
,, 21	,, 23	,, 27	May 1	,, 11	,, 18	27	,, 30
,, 22	,, 24	,, 28	,, 2	,, 12	,, 19	27	Dec. 1
,, 23	,, 25	,, 29	,, 3	,, 13	,, 20	27	,, 2
,, 24	,, 26	,, 30	,, 4	,, 14	,, 21	27	,, 3
,, 25	,, 27	May 1	,, 5	,, 15	,, 22	26	Nov. 27
,, 26	,, 28	,, 2	,, 6	,, 16	,, 23	26	,, 28
,, 27	,, 29	,, 3	,, 7	,, 17	,, 24	26	,, 29
,, 28	,, 30	,, 4	,, 8	,, 18	,, 25	26	,, 30
,, 29	,, 31	,, 5	,, 9	,, 19	,, 26	26	Dec. 1
,, 30	Ap 1	,, 6	,, 10	,, 20	,, 27	26	,, 2
,, 31	,, 2	,, 7	,, 11	,, 21	,, 28	26	,, 3
Apr. 1	,, 3	,, 8	,, 12	,, 22	,, 29	25	Nov. 27
,, 2	,, 4	,, 9	,, 13	,, 23	,, 30	25	,, 28
,, 3	,, 5	,, 10	,, 14	,, 24	,, 31	25	,, 29
,, 4	,, 6	,, 11	,, 15	,, 25	June 1	25	,, 30
,, 5	,, 7	,, 12	,, 16	,, 26	,, 2	25	Dec. 1
,, 6	,, 8	,, 13	,, 17	,, 27	,, 3	25	,, 2
,, 7	,, 9	,, 14	,, 18	,, 28	,, 4	25	,, 3
,, 8	,, 10	,, 15	,, 19	,, 29	,, 5	24	Nov. 27
,, 9	,, 11	,, 16	,, 20	,, 30	,, 6	24	,, 28
,, 10	,, 12	,, 17	,, 21	,, 31	,, 7	24	,, 29
,, 11	,, 13	,, 18	,, 22	June 1	,, 8	24	,, 30
,, 12	,, 14	,, 19	,, 23	,, 2	,, 9	24	Dec. 1
,, 13	,, 15	,, 20	,, 24	,, 3	,, 10	24	,, 2
,, 14	,, 16	,, 21	,, 25	,, 4	,, 11	24	,, 3
,, 15	,, 17	,, 22	,, 26	,, 5	,, 12	23	Nov. 27
,, 16	,, 18	,, 23	,, 27	,, 6	,, 13	23	,, 28
,, 17	,, 19	,, 24	,, 28	,, 7	,, 14	23	,, 29
,, 18	,, 20	,, 25	,, 29	,, 8	,, 15	23	,, 30
,, 19	,, 21	,, 26	,, 30	,, 9	,, 16	23	Dec. 1
,, 20	,, 22	,, 27	,, 31	,, 10	,, 17	23	,, 2
,, 21	,, 23	,, 28	June 1	,, 11	,, 18	23	,, 3
,, 22	,, 24	,, 29	,, 2	,, 12	,, 19	22	Nov. 27
,, 23	,, 25	,, 30	,, 3	,, 13	,, 20	22	,, 28

1830. The following is an abstract of clause VI. of the Act:—"Hilary Term shall begin on the 11th and end on the 31st

day of January; Easter Term shall begin on the fifteenth day of April, and end on the eighth day of May; Trinity Term shall begin on the twenty-second day of May, and end on the twelfth day of June; and Michaelmas Term shall begin on the second and end on the twenty-fifth day of November; and that the Essoign and General Return Days of each Term shall, until further provision be made by Parliament, be as follows; that is to say, the first Essoign or General Return day for every Term shall be the fourth day before the day of the commencement of the Term, both days being included in the computation; the second Essoign day shall be the fifth day of the Term; the third shall be the fifteenth day of the Term; and the fourth and last shall be the nineteenth day of the Term, the first day of the Term being already included in the computation; with the same relation to the commencement of each Term as they now bear, and shall be distinguished by the day of the Term on which they respectively fall, the Monday being in all cases substituted for the Sunday when it shall happen that the day would fall on Sunday, except always that in Easter Term there shall be but four Returns instead of five, the last being omitted; provided that in case the day of the month on which any Term according to the Act aforesaid is to end shall fall to be on a Sunday, then the Monday next after such day shall be deemed and taken to be the last day of the Term; and that if the whole or any number of the days[1] intervening *between* the *Thursday before and the Wednesday next after Easter-day* shall fall within Easter Term, there shall be no Sittings in Banc on any of such intervening days, but the Term shall in such case be prolonged and continue for such number of *days of business* as shall be equal to the number

[1] The intervening days, exclusive of Easter-day, are

Good Friday,
Saturday,
Easter Monday,
Easter Tuesday.

of the intervening days before mentioned exclusive of Easter-day, and the commencement of the ensuing Trinity Term shall in such case be postponed and its continuance prolonged for an equal number of *days of business*."

The wording of the Act is somewhat confused and obscure, and its correct interpretation and practical application require some little consideration. In order to obviate this inconvenience, as these terms are not yet entirely obsolete, we annex the following table, in which the dates of the commencement and ending of the several terms are made to depend simply on the Number of Direction.

Table of the OLD LAW TERMS, *according to the Number of Direction.*

No. of Direction (*N*).	Name.	Begins.	Ends.	No. of days.
1, 2, 3, 5, 8, 9, 10, 12, 15, 16, 17, 19, 22	Hilary Term	Jan. 11	Jan. 31	21
	Easter ,,	Apr. 15	May 8	24
	Trinity ,,	May 22	June 12	22
	Michaelmas ,,	Nov. 2	Nov. 25	24
4	Hilary Term	Jan. 11	Jan. 31	21
11	Easter ,,	Apr. 15	May 8	24
18	Trinity ,,	May 22	June 12	22
	Michaelmas ,,	Nov. 2	Nov. 26	25
6	Hilary Term	Jan. 11	Jan. 31	21
			Feb. 1 (bis.)	22
13	Easter ,,	Apr. 15	May 9	25
20	Trinity ,,	May 22	June 13	23
	Michaelmas ,,	Nov. 2	Nov. 25	24
7	Hilary Term	Jan. 11	Feb. 1	22
			Jan. 31 (bis.)	21
14	Easter ,,	Apr. 15	May 8	24
21	Trinity ,,	May 22	June 12	22
	Michaelmas ,,	Nov. 2	Nov. 25	24
23	Hilary Term	Jan. 11	Jan. 31	21
	Easter ,,	Apr. 15	May 9	25
	Trinity ,,	May 23	June 13	22
	Michaelmas ,,	Nov. 2	Nov. 25	24
24	Hilary Term	Jan. 11	Jan. 31	21
	Easter ,,	Apr. 15	May 10	26
	Trinity ,,	May 24	June 14	22
	Michaelmas ,,	Nov. 2	Nov. 25	24

Table of the Old Law Terms, *according to the Number of Direction.*

No. of Direction (*N*).	Name.	Begins.	Ends.	No. of days.
25	Hilary Term	Jan. 11	Jan. 31	21
	Easter ,,	Apr. 15	May 10	26
	Trinity ,,	May 24	June 14	22
	Michaelmas ,,	Nov. 2	Nov. 26	25
26	Hilary Term	Jan. 11	Jan. 31	21
	Easter ,,	Apr. 15	May 11	27
	Trinity ,,	May 25	June 15	22
	Michaelmas ,,	Nov. 2	Nov. 25	24
27 34	Hilary Term	Jan. 11	Jan. 31 / Feb. 1 (bis.)	21 / 22
	Easter ,,	Apr. 15	May 12	28
	Trinity ,,	May 26	June 16	22
	Michaelmas ,,	Nov. 2	Nov. 25	24
28 35	Hilary Term	Jan. 11	Feb. 1 / Jan. 31 (bis.)	22 / 21
	Easter ,,	Apr. 15	May 13	29
	Trinity ,,	May 27	June 17	22
	Michaelmas ,,	Nov. 2	Nov. 25	24
29, 30, 31	Hilary Term	Jan. 11	Jan. 31	21
	Easter ,,	Apr. 15	May 13	29
	Trinity ,,	May 27	June 17	22
	Michaelmas ,,	Nov. 2	Nov. 25	24
32	Hilary Term	Jan. 11	Jan. 31	21
	Easter ,,	Apr. 15	May 12	28
	Trinity ,,	May 26	June 16	22
	Michaelmas ,,	Nov. 2	Nov. 26	25
33	Hilary Term	Jan. 11	Jan. 31	21
	Easter ,,	Apr. 15	May 12	28
	Trinity ,,	May 26	June 16	22
	Michaelmas ,,	Nov. 2	Nov. 25	24

Law Sittings.—On the 1st of November, 1875, the Judicature Act, 1873, came into force, and the division of the legal year into terms was abolished so far as relates to the administration of justice. The Rules of Court provide that there shall be four sittings in every year of the Court of Appeal and High Court of Justice, namely :—

1. Michaelmas Sittings, beginning October 24, ending December 21.
2. Hilary Sittings, beginning January 11, ending Wednesday before Easter.
3. Easter Sittings, beginning Tuesday after Easter week, ending Friday before Whit Sunday.
4. Trinity Sittings, beginning Tuesday after Whitsun week, ending August 12.

There are also Law Terms in use observed by the Inns of Court. These terms are—

Hilary.—Same as old Law Term, January 11 to January 31 or February 1.
Easter.—The first 28 days of the Easter Law Sittings.
Trinity.—The first 21 days of the Trinity Law Sittings.
Michaelmas.—Same as old Law Term, November 2 to November 25 or November 26.

University Terms.—The University Terms may also be obtained simply from the Number of Direction by means of the following formulary table :—

N.					Oxford Act.	Cambridge Commencement.
2	9	16	23	30	July 1	June 17
3	10	17	24	31	„ 2	„ 18
4	11	18	25	32	„ 3	„ 19
5	12	19	26	33	„ 4	„ 20
6	13	20	27	34	„ 5	„ 21
7	14	21	28	35	„ 6	„ 22
1 8	15	22	29		„ 7	„ 23

Oxford University Terms.

When the beginning or ending of a Term falls on a festival, the rule is to take the day *after*, excepting the *ending* of Easter Term, which is to be the day *before*. The festivals, *besides Sundays*, which interfere are—

Annunciation	March 25.
St. Mark	April 25.
Accession Chas. II.	May 29.
St. Barnabas	June 11.

The Act, *first* Tuesday in July.

Hilary.	Term begins Jan. 14	ends Mar. $13+N$
	(if Sunday) Jan. 15	or Mar. $15+N$ (if $N=12$)
Easter	,, ,, Mar. $24+N$	,, May $7+N$
	(if $N=1,32$) Mar. $25+N$	or May $6+N$ (if $N=35$)
Trinity	,, ,, May $8+N$	,, The Act $+4$
	(if $N=34$) May $10+N$	
Michaelmas	,, ,, Oct. 10	,, Dec. 17
	(if Sunday) Oct. 11	(if Sunday) Dec. 18

CAMBRIDGE UNIVERSITY TERMS *before* 1884.

Commencement, Tuesday *before* Midsummer.

Hilary	Term begins Jan. 13	ends Mar. $12+N$
Easter	,, ,, Mar. $26+N$	,, Comm. $+3$
Michaelmas	,, ,, Oct. 1	,, Dec. 16
Hilary	Term divides	Feb. $11+\frac{1}{2}N$
	(bis)	Feb. $11+\frac{1}{2}(N+1)$
Easter	,, divides	May $\frac{1}{2}$ (N + Comm. -1)
Michaelmas	,, ,, ...	Nov. 8, noon.

(See page 207.)

To facilitate the construction of the Gregorian Calendar for any proposed year, the following table is inserted, showing the dominical letter, golden number, epact, number of direction, and Easter Sunday for three centuries, namely, from 1800 to 2100. It is only requisite to take the number of direction from the last column but one, and, with it, to enter the table on pages 172 and 173, and everything becomes immediately known without any calculation.

Elements of the GREGORIAN CALENDAR *for Three Centuries*, 1800 *to* 2100.

Year.	Dominical Letter.	Golden Number (g).	Epact (e).	No. of Direction (N).	Easter Sunday.
1800	E	15	4	23	April 13.
1801	D	16	15	15	April 5.
1802	C	17	26	28	April 18.
1803	B	18	7	20	April 10.
1804	AG	19	18	11	April 1.

Year.	Dominical Letter.	Golden Number (*g*).	Epact (*e*).	No. of Direction (*N*).	Easter Sunday.
1805	F	1	*	24	April 14.
1806	E	2	11	16	April 6.
1807	D	3	22	8	March 29.
1808	CB	4	3	27	April 17.
1809	A	5	14	12	April 2.
1810	G	6	25	32	April 22.
1811	F	7	6	24	April 14.
1812	ED	8	17	8	March 29.
1813	C	9	28	28	April 18.
1814	B	10	9	20	April 10.
1815	A	11	20	5	March 26.
1816	GF	12	1	24	April 14.
1817	E	13	12	16	April 6.
1818	D	14	23	1	March 22.
1819	C	15	4	21	April 11.
1820	BA	16	15	12	April 2.
1821	G	17	26	32	April 22.
1822	F	18	7	17	April 7.
1823	E	19	18	9	March 30.
1824	DC	1	*	28	April 18.
1825	B	2	11	13	April 3.
1826	A	3	22	5	March 26.
1827	G	4	3	25	April 15.
1828	FE	5	14	16	April 6.
1829	D	6	25	29	April 19.
1830	C	7	6	21	April 11.
1831	B	8	17	13	April 3.
1832	AG	9	28	32	April 22.
1833	F	10	9	17	April 7.
1834	E	11	20	9	March 30.
1835	D	12	1	29	April 19.
1836	CB	13	12	13	April 3.
1837	A	14	23	5	March 26.
1838	G	15	4	25	April 15.
1839	F	16	15	10	March 31.

Year.	Dominical Letter.	Golden Number (*g*).	Epact (*e*).	No. of Direction (*N*).	Easter Sunday.
1840	ED	17	26	29	April 19.
1841	C	18	7	21	April 11.
1842	B	19	18	6	March 27.
1843	A	1	*	26	April 16.
1844	GF	2	11	17	April 7.
1845	E	3	22	2	March 23.
1846	D	4	3	22	April 12.
1847	C	5	14	14	April 4.
1848	BA	6	25	33	April 23.
1849	G	7	6	18	April 8.
1850	F	8	17	10	March 31.
1851	E	9	28	30	April 20.
1852	DC	10	9	21	April 11.
1853	B	11	20	6	March 27.
1854	A	12	1	26	April 16.
1855	G	13	12	18	April 8.
1856	FE	14	23	2	March 23.
1857	D	15	4	22	April 12.
1858	C	16	15	14	April 4.
1859	B	17	26	34	April 24.
1860	AG	18	7	18	April 8.
1861	F	19	18	10	March 31.
1862	E	1	30	30	April 20.
1863	D	2	11	15	April 5.
1864	CB	3	22	6	March 27.
1865	A	4	3	26	April 16.
1866	G	5	14	11	April 1.
1867	F	6	25	31	April 21.
1868	ED	7	6	22	April 12.
1869	C	8	17	7	March 28.
1870	B	9	28	27	April 17.
1871	A	10	9	19	April 9.
1872	GF	11	20	10	March 31.
1873	E	12	1	23	April 13.
1874	D	13	12	15	April 5.

Year.	Dominical Letter.	Golden Number (*g*).	Epact (*e*).	No. of Direction (*S*).	Easter Sunday.
1875	C	14	23	7	March 28.
1876	BA	15	4	26	April 16.
1877	G	16	15	11	April 1.
1878	F	17	26	31	April 21.
1879	E	18	7	23	April 13.
1880	DC	19	18	7	March 28.
1881	B	1	*	27	April 17.
1882	A	2	11	19	April 9.
1883	G	3	22	4	March 25.
1884	FE	4	3	23	April 13.
1885	D	5	14	15	April 5.
1886	C	6	25	35	April 25.
1887	B	7	6	20	April 10.
1888	AG	8	17	11	April 1.
1889	F	9	28	31	April 21.
1890	E	10	9	16	April 6.
1891	D	11	20	8	March 29.
1892	CB	12	1	27	April 17.
1893	A	13	12	12	April 2.
1894	G	14	23	4	March 25.
1895	F	15	4	24	April 14.
1896	ED	16	15	15	April 5.
1897	C	17	26	28	April 18.
1898	B	18	7	20	April 10.
1899	A	19	18	12	April 2.
1900	G	1	29	25	April 15.
1901	F	2	10	17	April 7.
1902	E	3	21	9	March 30.
1903	D	4	2	22	April 12.
1904	CB	5	13	13	April 3.
1905	A	6	24	33	April 23.
1906	G	7	5	25	April 15.
1907	F	8	16	10	March 31.
1908	ED	9	27	29	April 19.
1909	C	10	8	21	April 11.

Year.	Dominical Letter.	Golden Number (g).	Epact (ϵ).	No. of Direction (N).	Easter Sunday.
1910	B	11	19	6	March 27.
1911	A	12	*	26	April 16.
1912	GF	13	11	17	April 7.
1913	E	14	22	2	March 23.
1914	D	15	3	22	April 12.
1915	C	16	14	14	April 4.
1916	BA	17	26	33	April 23.
1917	G	18	6	18	April 8.
1918	F	19	17	10	March 31.
1919	E	1	29	30	April 20.
1920	DC	2	10	14	April 4.
1921	B	3	21	6	March 27.
1922	A	4	2	26	April 16.
1923	G	5	13	11	April 1.
1924	FE	6	24	30	April 20.
1925	D	7	5	22	April 12.
1926	C	8	16	14	April 4.
1927	B	9	27	27	April 17.
1928	AG	10	8	18	April 8.
1929	F	11	19	10	March 31.
1930	E	12	*	30	April 20.
1931	D	13	11	15	April 5.
1932	CB	14	22	6	March 27.
1933	A	15	3	26	April 16.
1934	G	16	14	11	April 1.
1935	F	17	26	31	April 21.
1936	ED	18	6	22	April 12.
1937	C	19	17	7	March 28.
1938	B	1	29	27	April 17.
1939	A	2	10	19	April 9.
1940	GF	3	21	3	March 24.
1941	E	4	2	23	April 13.
1942	D	5	13	15	April 5.
1943	C	6	24	35	April 25.
1944	BA	7	5	19	April 9.

Year.	Dominical Letter.	Golden Number (*g*).	Epact (*e*).	No. of Direction (*N*).	Easter Sunday.
1945	G	8	16	11	April 1.
1946	F	9	27	31	April 21.
1947	E	10	8	16	April 6.
1948	DC	11	19	7	March 28.
1949	B	12	*	27	April 17.
1950	A	13	11	19	April 9.
1951	G	14	22	4	March 25.
1952	FE	15	3	23	April 13.
1953	D	16	14	15	April 5.
1954	C	17	26	28	April 18.
1955	B	18	6	20	April 10.
1956	AG	19	17	11	April 1.
1957	F	1	29	31	April 21.
1958	E	2	10	16	April 6.
1959	D	3	21	8	March 29.
1960	CB	4	2	27	April 17.
1961	A	5	13	12	April 2.
1962	G	6	24	32	April 22.
1963	F	7	5	24	April 14.
1964	ED	8	16	8	March 29.
1965	C	9	27	28	April 18.
1966	B	10	8	20	April 10.
1967	A	11	19	5	March 26.
1968	GF	12	*	24	April 14.
1969	E	13	11	16	April 6.
1970	D	14	22	8	March 29.
1971	C	15	3	21	April 11.
1972	BA	16	14	12	April 2.
1973	G	17	26	32	April 22.
1974	F	18	6	24	April 14.
1975	E	19	17	9	March 30.
1976	DC	1	29	28	April 18.
1977	B	2	10	20	April 10.
1978	A	3	21	5	March 26.
1979	G	4	2	25	April 15.

Year.	Dominical Letter.	Golden Number (*g*).	Epact (*e*).	No. of Direction (*N*).	Easter Sunday.
1980	FE	5	13	16	April 6.
1981	D	6	24	29	April 19.
1982	C	7	5	21	April 11
1983	B	8	16	13	April 3.
1984	AG	9	27	32	April 22
1985	F	10	8	17	April 7.
1986	E	11	19	9	March 30.
1987	D	12	*	29	April 19.
1988	CB	13	11	13	April 3.
1989	A	14	22	5	March 26.
1990	G	15	3	25	April 15.
1991	F	16	14	10	March 31.
1992	ED	17	26	29	April 19.
1993	C	18	6	21	April 11.
1994	B	19	17	13	April 3.
1995	A	1	29	26	April 16.
1996	GF	2	10	17	April 7.
1997	E	3	21	9	March 30.
1998	D	4	2	22	April 12.
1999	C	5	13	14	April 4.
2000	BA	6	24	33	April 23.
2001	G	7	5	25	April 15.
2002	F	8	16	10	March 31.
2003	E	9	27	30	April 20.
2004	DC	10	8	21	April 11.
2005	B	11	19	6	March 27.
2006	A	12	*	26	April 16.
2007	G	13	11	18	April 8.
2008	FE	14	22	2	March 23.
2009	D	15	3	22	April 12.
2010	C	16	14	14	April 4.
2011	B	17	26	34	April 24.
2012	AG	18	6	18	April 8.
2013	F	19	17	10	March 31.
2014	E	1	29	30	April 20.

Year.	Dominical Letter.	Golden Number (*g*).	Epact (*e*).	No. of Direction (*N*).	Easter Sunday.
2015	D	2	10	15	April 5.
2016	CB	3	21	6	March 27.
2017	A	4	2	26	April 16.
2018	G	5	13	11	April 1.
2019	F	6	24	31	April 21.
2020	ED	7	5	22	April 12.
2021	C	8	16	14	April 4.
2022	B	9	27	27	April 17.
2023	A	10	8	19	April 9.
2024	GF	11	19	10	March 31.
2025	E	12	*	30	April 20.
2026	D	13	11	15	April 5.
2027	C	14	22	7	March 28.
2028	BA	15	3	26	April 16.
2029	G	16	14	11	April 1.
2030	F	17	26	31	April 21.
2031	E	18	6	23	April 13.
2032	DC	19	17	7	March 28.
2033	B	1	29	27	April 17.
2034	A	2	10	19	April 9.
2035	G	3	21	4	March 25.
2036	FE	4	2	23	April 13.
2037	D	5	13	15	April 5.
2038	C	6	24	35	April 25.
2039	B	7	5	20	April 10.
2040	AG	8	16	11	April 1.
2041	F	9	27	31	April 21.
2042	E	10	8	16	April 6.
2043	D	11	19	8	March 29.
2044	CB	12	*	27	April 17.
2045	A	13	11	19	April 9.
2046	G	14	22	4	March 25.
2047	F	15	3	24	April 14.
2048	ED	16	14	15	April 5.
2049	C	17	26	28	April 18.

Year.	Dominical Letter.	Golden Number (*g*).	Epact (*e*).	No of Direction (*N*).	Easter Sunday.
2050	B	18	6	20	April 10.
2051	A	19	17	12	April 2.
2052	GF	1	29	31	April 21.
2053	E	2	10	16	April 6.
2054	D	3	21	8	March 29.
2055	C	4	2	28	April 18.
2056	BA	5	13	12	April 2.
2057	G	6	24	32	April 22.
2058	F	7	5	24	April 14.
2059	E	8	16	9	March 30.
2060	DC	9	27	28	April 18.
2061	B	10	8	20	April 10.
2062	A	11	19	5	March 26.
2063	G	12	*	25	April 15.
2064	FE	13	11	16	April 6.
2065	D	14	22	8	March 29.
2066	C	15	3	21	April 11.
2067	B	16	14	13	April 3.
2068	AG	17	26	32	April 22.
2069	F	18	6	24	April 14.
2070	E	19	17	9	March 30.
2071	D	1	29	29	April 19.
2072	CB	2	10	20	April 10.
2073	A	3	21	5	March 26.
2074	G	4	2	25	April 15.
2075	F	5	13	17	April 7.
2076	ED	6	24	29	April 19.
2077	C	7	5	21	April 11.
2078	B	8	16	13	April 3.
2079	A	9	27	33	April 23.
2080	GF	10	8	17	April 7.
2081	E	11	19	9	March 30.
2082	D	12	*	29	April 19.
2083	C	13	11	14	April 4.
2084	BA	14	22	5	March 26.

Year.	Dominical Letter	Golden Number (*g*).	Epact (*e*).	No. of Direction (*N*).	Easter Sunday.
2085	G	15	3	25	April 15.
2086	F	16	14	10	March 31.
2087	E	17	26	30	April 20.
2088	DC	18	6	21	April 11.
2089	B	19	17	13	April 3.
2090	A	1	29	26	April 16.
2091	G	2	10	18	April 8.
2092	FE	3	21	9	March 30.
2093	D	4	2	22	April 12.
2094	C	5	13	14	April 4.
2095	B	6	24	34	April 24.
2096	AG	7	5	25	April 15.
2097	F	8	16	10	March 31.
2098	E	9	27	30	April 20.
2099	D	10	8	22	April 12.
2100	C	11	19	7	March 28.

HEBREW CALENDAR.

A paper on the computation of the Hebrew Calendar was given by Mr. Herschell Fillipowski, in the "Lady and Gentleman's Diary," for the year 1850. As the Diary is out of print the following introductory extract may be acceptable:—

"Of all calendars known the Hebrew Calendar is the most complicated. It is the more remarkable on account of its astronomical system as laid down by the Hebrews, A.D. 358, and which, to the present time, agrees in its results with the revolutions of both luminaries.

"The Hebrew Calendar is composed either of twelve or thirteen months, the former being called a *common* the latter an *embolismic* year. The months receive alternately thirty and twenty-nine days; thus, in a common year the number of days amount to 354, whilst in an embolismic one they amount to 384; in both these cases they are called *regular*

years. The month of intercalation is always the twelfth in the year, and invariably receives thirty days; it is then called ADAR THE FIRST, whilst in a common year there is only one month of *Adar*.

"The year begins with the month of TISHRI, it being the seventh in the year, and is fixed on or immediately after the day of the mean new moon of that month (which always takes place during the month of September), provided the new moon does not occur within the last six hours of the day (the day commences and terminates at 6 p.m.).

"The new year is not to be fixed on either of the following days—Sunday, Wednesday, or Friday; accordingly, if the new moon happens to take place on either of these three days, though within the first eighteen hours of the day, the new year is postponed respectively to the next following day. These regulations cause, occasionally, either the eighth month, *Heshvon*, to receive thirty days instead of twenty-nine, thus increasing the year with one day; or the ninth month, *Kislev*, to receive twenty-nine days instead of thirty, by which the year is made one day shorter.

"The time of one mean lunar revolution is assumed by the Hebrews to be 29 days, 12 hours, and $44\frac{1}{18}$ minutes, differing from the modern astronomers by only half a second. With this they have measured, without exception, all lunar months ever since the introduction of their calendar, the results of which seem to correspond closely with those of modern computation."

The Jews date their Calendar from the Creation, which is considered by them to have occurred 3760 years and 3 months before the commencement of the Christian era. The year is luni-solar, and, according as it is ordinary or embolismic, consists of twelve or thirteen lunar months, each of which has 29 or 30 days. It is occasionally made a day more or less than the mean value in order that certain festivals may fall on proper days of the week for their due observance. The days of the respective months, according to the number comprised in the different years, are distributed as follows:—

Month.	Ordinary year.			Embolismic year.		
	Imperfect.	Common.	Perfect.	Imperfect.	Common.	Perfect.
Tisri	30	30	30	30	30	30
Hesvan	29	29	30	29	29	30
Kislev	29	30	30	29	30	30
Tebet	29	29	29	29	29	29
Sebat	30	30	30	30	30	30
Adar	29	29	29	30	30	30
(Veadar)	..	..	..	(29)	(29)	(29)
Nisan	30	30	30	30	30	30
Yiar	29	29	29	29	29	29
Sivan	30	30	30	30	30	30
Tamuz	29	29	29	29	29	29
Ab	30	30	30	30	30	30
Elul	29	29	29	29	29	29
No. of days in the year	353	354	355	383	384	385

The intercalary month, Veadar, is introduced that Passover, the 15th day of Nisan, may be kept at its proper season, which is the full moon of the vernal equinox, or that which takes place after the sun has entered the sign Aries. The distribution of the embolismic years is determined by a cycle of 19 years, according to the following rule.

Divide the Hebrew year by 19, the quotient is the number of the last completed cycle, and the remainder is the year of the current cycle; should it be 3, 6, 8, 11, 14, 17, or 19 (0), the year is embolismic; if any other it is ordinary.

Or if Y denote the year, and

$$R = \left(\frac{7Y + 13}{19}\right)_r;$$

the year is embolismic when $R > 11$.

The calendar is constructed by assuming the mean lunation to be 29 days 12 hours 44 min. $3\frac{1}{3}$ sec., and that the year commences on, or immediately after, the new moon

following the autumnal equinox. The mean solar year is also assumed to be 365 days 5 hours 55 min. $25\frac{2}{3}\frac{5}{7}$ sec.[1], so that a cycle of nineteen of such years contains 6939 days 16 hours 33 min. $3\frac{1}{3}$ sec., the exact measure of 235 of the assumed lunations. The year 5606 was the first of a cycle, and the computed new moon answering to the 1st of Tisri for that year was 1845, Oct. 1, 15h. 42m. $43\frac{1}{3}$s., according to Lindo, adopting the civil mode of reckoning from the previous midnight. The future times of new moon are consequently deduced by successively adding 29 days 12h. 44m. $3\frac{1}{3}$s. to this date.

Or to compute the times of new moon which belong to the commencement of successive years, we must in passing from an ordinary year, deduce the new moon of the following year by subtracting the interval that twelve lunations fall short of the corresponding Gregorian year of 365 or 366 days; and for an embolismic year we must add the excess of thirteen lunations over the Gregorian year; that is, to get the new moon of Tisri for the year immediately following any given year Y, we must,

for an ordinary year, subtract $\left\{\begin{matrix}10\\11\end{matrix}\right\}$ days 15h. 11m. 20s.,

„ embolismic „ add $\left\{\begin{matrix}18\\17\end{matrix}\right\}$ days 21h. 32m. $43\frac{1}{3}$s.,

the second mentioned number of days being used whenever the year Y is divisible by 4 without a remainder, or, more correctly, when the following or new Gregorian year is bissextile.

Thus, by knowing which of the years are embolismic, from their ordinal position in the cycle, according to the rule before stated, the times of the commencement of successive years may be carried on indefinitely without much trouble.

[1] This being 6 min. 37 sec. in excess of the mean solar year, the dates of commencement of future Jewish years so calculated will advance forward from the equinox a day in error in every 218 years. The lunations it will be observed, are estimated with greater precision.

We annex a few by way of example, and have distinguished by a * the years which are embolismic and bissextile. The hours are counted from the previous midnight, according to the civil reckoning.

			d.	h.	m.	s.
Year 5606,	year of cycle 1,	date 1845	Oct. 1	15	42	$43\frac{1}{3}$
5607	„ „ 2,	„ 1846	Sept. 21	0	31	$23\frac{1}{3}$
5608	„ „ *3,	„ 1847	„ 10	9	20	$3\frac{1}{3}$
5609	„ „ 4,	„ *1848	„ 28	6	52	$46\frac{2}{3}$
5610	„ „ 5,	„ 1849	„ 17	15	41	$26\frac{2}{3}$
5611	„ „ *6,	„ 1850	„ 7	0	30	$6\frac{2}{3}$
5612	„ „ 7,	„ 1851	„ 25	22	2	50
5613	„ „ *8,	„ *1852	„ 14	6	51	30
5614	„ „ 9,	„ 1853	Oct. 3	4	24	$13\frac{1}{3}$
&c.		&c.			&c.	

But it must be observed, for the reasons before assigned, to avoid certain festivals falling on incompatible days of the week, that the year must not begin on a Sunday, Wednesday, or Friday, so that if the computed conjunction falls on one of these days the new year is to be fixed on the day after. The following conditions also require to be attended to:—

If the computed new moon be after 12h. the following day is to be taken, and if that happen to be Sunday, Wednesday, or Friday, it must be postponed one day more.

If in an ordinary year the new moon is on Tuesday, as late as 9h. 11m. 20s., it is not to be observed thereon; and, as it may not be held on Wednesday, it is to be postponed to Thursday.

If in a year immediately following an embolismic year the new moon is on Monday, as late as 15h. 30m. 52s., the new year is to be fixed on Tuesday.

The number of days contained in any given Jewish year, and the day of the week on which it commences, may be readily calculated by means of the following tables, the use of which will be best explained by an example.

Example.—Required the character of the Jewish year 5640.

Having found the next less year in the table of completed cycles, the calculation is as follows:—

Proposed year	5640		
296 cycles	5624	Number	2525,480
Year of cycle..	16	($R = 11$)	2278,271
		Sum	4803,751

Referring to the third table in the column under $R = 11$, the number next less to this sum is 4743,996, and it stands opposite to "354 Thur.," showing that the year is ordinary, contains 354 days, and begins on a Thursday.

By the second table the approximate date of commencement is 17 Sept., and the corresponding year of our Lord is 5640 — 3761 = 1879. Now, referring to the table, page 146, the Dominical letter for this year is E, and 17 Sept. is Wednesday. Therefore, as the Jewish year has been found to begin on a Thursday, the true date of commencement is 18 Sept. 1879.

The Gregorian epact being the age of the moon of Tebet at the beginning of the year, it represents the day of Tebet which corresponds to Jan. 1; and the approximate date of Tisri 1 may be otherwise deduced by subtracting the epact

$$\text{from } \left\{\begin{matrix}\text{Sept. } 24\\ \text{Oct. } 24\end{matrix}\right\} \text{ after an } \left\{\begin{matrix}\text{ordinary}\\ \text{embolismic}\end{matrix}\right\} \text{ year.}$$

The result so obtained would in general be more accurate than the Jewish calculation, and it may differ a day from the latter, as fractions of a day are omitted in these computations. The difference may, however, be adjusted as before by means of the day of the week.

Completed Cycles.	Year.	Number.
295	5605	1200,895
296	5624	2525,480
297	5643	402,705
298	5662	1727,290
299	5681	3051,875
300	5700	929,100
301	5719	2253,685
302	5738	130,910
303	5757	1455,495
304	5776	2780,080
305	5795	657,305
306	5814	1981,890
307	5833	3306,475
308	5852	1183,700
309	5871	2508,285
310	5890	385,510
311	5909	1710,095
312	5928	3034,680
313	5947	911,905
314	5966	2236,490
315	5985	113,715
316	6004	1438,300
317	6023	2762,885
318	6042	640,110
319	6061	1964,695
320	6080	3289,280

Year of Cycle.	*R.*	Number.	Approximate Commencement (Tisri 1).
1	1	722,076	2 Oct. *
2	8	2872,800	21 Sept.
3	15	1576,164	10 ,,
4	3	1033,315	29 ,,
5	10	3184,039	18 Sept.
6	17	1887,403	8 ,,
7	5	1344,554	27 ,,
8	12	47,918	15 ,,
9	0	2952,429	4 Oct.
10	7	1655,793	23 Sept.
11	14	359,157	12 ,,
12	2	3263,668	1 Oct.
13	9	1967,032	20 Sept.
14	16	670,396	9 ,,
15	4	127,547	28 Sept.
16	11	2278,271	17 ,,
17	18	981,635	6 ,,
18	6	438,786	25 ,,
19	13	2589,510	14 ,,

* The corresponding year of our Lord is obtained by subtracting 3761 from the Jewish year, and *vice versâ;* and the approximate date of commencement may be adjusted to the accurate date by means of the true day of the week taken from the next table.

Ordinary Years.				Embolismic Years.	
Character.	$R = 0 \ldots 4$	$R = 5, 6$	$R = 7 \ldots 11$	$R = 12 \ldots 18$	Character.
353 Mon.	0	0	0	0	383 Mon.
355 Mon.	311,676	311,676	311,676	542,849	385 Mon.
354 Tues.	934,591	934,591	984,960	984,960	384 Tues.
354 Thur.	1296,636	1296,636	1296,636	1477,440	383 Thur.
355 Thur.	2281,596	2281,596	2281,596	1839,485	385 Thur.
353 Sat.	2462,400	2462,400	2462,400	2462,400	383 Sat.
355 Sat.	2593,272	2774,076	2774,076	3005,249	385 Sat.
353 Mon.	3447,360	3447,360	3447,360	3447,360	383 Mon.
355 Mon.	3759,036	3759,036	3759,036	3990,209	385 Mon.
354 Tues.	4381,951	4381,951	4432,320	4432,320	384 Tues.
354 Thur.	4743,996	4743,996	4743,996	4924,800	383 Thur.
355 Thur.	5728,956	5728,956	5728,956	5286,845	385 Thur.
353 Sat.	5909,760	5909,760	5909,760	5909,760	383 Sat.
355 Sat.	6040,632	6221,436	6221,436	6452,609	385 Sat.

The annexed table exhibits the principal fasts and festivals, and it is followed by a table of the dates, &c. of Jewish years up to the year 2072, and the completion of the 307th cycle. When the date of commencement and number of days contained in a year are known, the number of days contained in the several months are shown in the table, page 189, and the construction of a detailed calendar for that year is obvious.

Principal Days of the JEWISH CALENDAR.

Tebet	1	1st of Tebet.	
,,	10 Fast	Fast; Siege of Jerusalem.	
Sebat	1	1st of Sebat.	
Adar	1	1st of Adar.	
,,	13, or 11 if Tisri 1 be Thursday	Fast of Esther	In Embol Years substitute *Veadar*, and same days.
,,	14 Purim	Purim	
,,	15 Purim	Second Day	
Veadar	1	1st of Veadar (if Embolismic Year).	
Nisan	1	1st of Nisan.	
,,	15 Passover	Passover.	
,,	16 Passover	Second Day.	
Yiar	1	1st of Yiar.	
Sivan	1	1st of Sivan.	
,,	6 Sebuot	Pentecost.	
,,	7 Sebuot	Second Day.	
Tamuz	1	1st of Tamuz.	
,,	17, or 18 if Tisri 1 be Monday	Fast; Taking of Jerusalem.	
Ab	1	1st of Ab.	
,,	9, or 10 if Tisri 1 be Monday	Fast; Destruction of the Temple.	
Elul	1	1st of Elul.	
Tisri	1 New Year	1st of Tisri (Yr .... begins).	
,,	2	Second Day.	
,,	3, or 4 if Tisri 1 be Thursday	Fast of Guedaliah.	
,,	10 Kipur	Fast of Expiation.	
,,	15 Tabernacle.	Feast of Tabernacles.	
,,	16 Tabernacle.	Second Day.	
,,	21 Hosana Raba	Last day of the Festival.	
,,	22 8th day	Feast of the 8th day.	
,,	23 8th day	Rejoicing of the Law.	
Hesvan	1	1st of Hesvan.	
Kislev	1	1st of Kislev.	
	25 Hanuca	Dedication of the Temple.	
Tebet	1	1st of Tebet.	
	&c.	&c.	

Table of HEBREW YEARS.

	Jewish Year.	Number of Days.	Commencement (1st of Tisri).		
296 Cycle.	5606	354	Thur.	2 Oct.	1845
	07	355	Mon.	21 Sept.	1846
	08	383	Sat.	11 Sept.	1847
	09	354	Thur.	28 Sept.	1848
	10	355	Mon.	17 Sept.	1849
	11	385	Sat.	7 Sept.	1850
	12	353	Sat.	27 Sept.	1851
	13	384	Tues.	14 Sept.	1852
	14	355	Mon.	3 Oct.	1853
	15	355	Sat.	23 Sept.	1854
	16	383	Thur.	13 Sept.	1855
	17	354	Tues.	30 Sept.	1856
	18	355	Sat.	19 Sept.	1857
	19	385	Thur.	9 Sept.	1858
	20	354	Thur.	29 Sept.	1859
	21	353	Mon.	17 Sept.	1860
	22	385	Thur.	5 Sept.	1861
	23	354	Thur.	25 Sept.	1862
	24	383	Mon.	14 Sept.	1863
297 Cycle.	5625	355	Sat.	1 Oct.	1864
	26	354	Thur.	21 Sept.	1865
	27	385	Mon.	10 Sept.	1866
	28	353	Mon.	30 Sept.	1867
	29	354	Thur.	17 Sept.	1868
	30	385	Mon.	6 Sept.	1869
	31	355	Mon.	26 Sept.	1870
	32	383	Sat.	16 Sept.	1871
	33	354	Thur.	3 Oct.	1872
	34	355	Mon.	22 Sept.	1873
	35	383	Sat.	12 Sept.	1874
	36	355	Thur.	30 Sept.	1875
	37	354	Tues.	19 Sept.	1876
	38	385	Sat.	8 Sept.	1877
	39	355	Sat.	28 Sept.	1878
	40	354	Thur.	18 Sept.	1879
	41	383	Mon.	6 Sept.	1880
	42	355	Sat.	24 Sept.	1881
	43	383	Thur.	14 Sept.	1882

	Jewish Year.	Number of Days.	Commencement (1st of Tisri).		
298 Cycle.	5644	354	Tues.	2 Oct.	1883
	45	355	Sat.	20 Sept.	1884
	46	385	Thur.	10 Sept.	1885
	47	354	Thur.	30 Sept.	1886
	48	353	Mon.	19 Sept.	1887
	49	385	Thur.	6 Sept.	1888
	50	354	Thur.	26 Sept.	1889
	51	383	Mon.	15 Sept.	1890
	52	355	Sat.	3 Oct.	1891
	53	354	Thur.	22 Sept.	1892
	54	385	Mon.	11 Sept.	1893
	55	353	Mon.	1 Oct.	1894
	56	355	Thur.	19 Sept.	1895
	57	384	Tues.	8 Sept.	1896
	58	355	Mon.	27 Sept.	1897
	59	353	Sat.	17 Sept.	1898
	60	384	Tues.	5 Sept.	1899
	61	355	Mon.	24 Sept.	1900
	62	383	Sat.	14 Sept.	1901
299 Cycle.	5663	355	Thur.	2 Oct.	1902
	64	354	Tues.	22 Sept.	1903
	65	385	Sat.	10 Sept.	1904
	66	355	Sat.	30 Sept.	1905
	67	354	Thur.	20 Sept.	1906
	68	383	Mon.	9 Sept.	1907
	69	355	Sat.	26 Sept.	1908
	70	383	Thur.	16 Sept.	1909
	71	354	Tues.	4 Oct.	1910
	72	355	Sat.	23 Sept.	1911
	73	385	Thur.	12 Sept.	1912
	74	354	Thur.	2 Oct.	1913
	75	353	Mon.	21 Sept.	1914
	76	385	Thur.	9 Sept.	1915
	77	354	Thur.	28 Sept.	1916
	78	355	Mon.	17 Sept.	1917
	79	383	Sat.	7 Sept.	1918
	80	354	Thur.	25 Sept.	1919
	81	385	Mon.	13 Sept.	1920

Table of HEBREW YEARS.

Jewish Year.	Number of Days.	Commencement (1st of Tisri).			Jewish Year.	Number of Days.	Commencement (1st of Tisri).		
5682	355	Mon.	3 Oct.	1921	5720	355	Sat.	3 Oct.	1959
83	353	Sat.	23 Sept.	1922	21	354	Thur.	22 Sept.	1960
84	384	Tues.	11 Sept.	1923	22	383	Mon.	11 Sept.	1961
85	355	Mon.	29 Sept.	1924	23	355	Sat.	29 Sept.	1962
86	355	Sat.	19 Sept.	1925	24	354	Thur.	19 Sept.	1963
87	383	Thur.	9 Sept.	1926	25	385	Mon.	7 Sept.	1964
88	354	Tues.	27 Sept.	1927	26	353	Mon.	27 Sept.	1965
89	385	Sat.	15 Sept.	1928	27	385	Thur.	15 Sept.	1966
300 Cycle. 90	353	Sat.	5 Oct.	1929	302 Cycle. 28	354	Thur.	5 Oct.	1967
91	354	Tues.	23 Sept.	1930	29	355	Mon.	23 Sept.	1968
92	385	Sat.	12 Sept.	1931	30	383	Sat.	13 Sept.	1969
93	355	Sat.	1 Oct.	1932	31	354	Thur.	1 Oct.	1970
94	354	Thur.	21 Sept.	1933	32	355	Mon.	20 Sept.	1971
95	383	Mon.	10 Sept.	1934	33	383	Sat.	9 Sept.	1972
96	355	Sat.	28 Sept.	1935	34	355	Thur.	27 Sept.	1973
97	354	Thur.	17 Sept.	1936	35	354	Tues.	17 Sept.	1974
98	385	Mon.	6 Sept.	1937	36	385	Sat.	6 Sept.	1975
99	353	Mon.	26 Sept.	1938	37	353	Sat.	25 Sept.	1976
5700	385	Thur.	14 Sept.	1939	38	384	Tues.	13 Sept.	1977
5701	354	Thur.	3 Oct.	1940	5739	355	Mon.	2 Oct.	1978
02	355	Mon.	22 Sept.	1941	40	355	Sat.	22 Sept.	1979
03	383	Sat.	12 Sept.	1942	41	383	Thur.	11 Sept.	1980
04	354	Thur.	30 Sept.	1943	42	354	Tues.	29 Sept.	1981
05	355	Mon.	18 Sept.	1944	43	355	Sat.	18 Sept.	1982
06	383	Sat.	8 Sept.	1945	44	385	Thur.	8 Sept.	1983
07	354	Thur.	26 Sept.	1946	45	354	Thur.	27 Sept.	1984
08	385	Mon.	15 Sept.	1947	303 Cycle. 46	383	Mon.	16 Sept.	1985
301 Cycle. 09	355	Mon.	4 Oct.	1948	47	355	Sat.	4 Oct.	1986
10	353	Sat.	24 Sept.	1949	48	354	Thur.	24 Sept.	1987
11	384	Tues.	12 Sept.	1950	49	383	Mon.	12 Sept.	1988
12	355	Mon.	1 Oct.	1951	50	355	Sat.	30 Sept.	1989
13	355	Sat.	20 Sept.	1952	51	354	Thur.	20 Sept.	1990
14	383	Thur.	10 Sept.	1953	52	385	Mon.	9 Sept.	1991
15	354	Tues.	28 Sept.	1954	53	353	Mon.	28 Sept.	1992
16	355	Sat.	17 Sept.	1955	54	355	Thur.	16 Sept.	1993
17	385	Thur.	6 Sept.	1956	55	384	Tues.	6 Sept.	1994
18	354	Thur.	26 Sept.	1957	56	355	Mon.	25 Sept.	1995
19	383	Mon.	15 Sept.	1958	57	383	Sat.	14 Sept.	1996

Table of HEBREW YEARS.

	Jewish Year.	Number of Days.	Commencement (1st of Tisri).		
304 Cycle.	5758	354	Thur.	2 Oct.	1997
	59	355	Mon.	21 Sept.	1998
	60	385	Sat.	11 Sept.	1999
	61	353	Sat.	30 Sept.	2000
	62	354	Tues.	16 Sept.	2001
	63	385	Sat.	7 Sept.	2002
	64	355	Sat.	27 Sept.	2003
	65	383	Thur.	16 Sept.	2004
	66	354	Tues.	4 Oct.	2005
	67	355	Sat.	23 Sept.	2006
	68	383	Thur.	13 Sept.	2007
	69	354	Tues.	30 Sept.	2008
	70	355	Sat.	19 Sept.	2009
	71	385	Thur.	9 Sept.	2010
	72	354	Thur.	29 Sept.	2011
	73	353	Mon.	17 Sept.	2012
	74	385	Thur.	5 Sept.	2013
	75	354	Thur.	25 Sept.	2014
	76	385	Mon.	14 Sept.	2015
305 Cycle.	5777	353	Mon.	3 Oct.	2016
	78	354	Thur.	21 Sept.	2017
	79	385	Mon.	10 Sept.	2018
	80	355	Mon.	30 Sept.	2019
	81	353	Sat.	19 Sept.	2020
	82	384	Tues.	7 Sept.	2021
	83	355	Mon.	26 Sept.	2022
	84	383	Sat.	16 Sept.	2023
	85	355	Thur.	3 Oct.	2024
	86	354	Tues.	23 Sept.	2025
	87	385	Sat.	12 Sept.	2026
	88	355	Sat.	2 Oct.	2027
	89	354	Thur.	21 Sept.	2028
	90	383	Mon.	10 Sept.	2029
	91	355	Sat.	28 Sept.	2030
	92	354	Thur.	18 Sept.	2031
	93	383	Mon.	6 Sept.	2032
	94	355	Sat.	24 Sept.	2033
	95	385	Thur.	14 Sept.	2034

	Jewish Year.	Number of Days.	Commencement (1st of Tisri).		
306 Cycle.	5796	354	Thur.	4 Oct.	2035
	97	353	Mon.	22 Sept.	2036
	98	385	Thur.	10 Sept.	2037
	99	354	Thur.	30 Sept.	2038
	5800	355	Mon.	19 Sept.	2039
	01	383	Sat.	8 Sept.	2040
	02	354	Thur.	26 Sept.	2041
	03	385	Mon.	15 Sept.	2042
	04	353	Mon.	5 Oct.	2043
	05	355	Thur.	22 Sept.	2044
	06	384	Tues.	12 Sept.	2045
	07	355	Mon.	1 Oct.	2046
	08	353	Sat.	21 Sept.	2047
	09	384	Tues.	8 Sept.	2048
	10	355	Mon.	27 Sept.	2049
	11	355	Sat.	17 Sept.	2050
	12	383	Thur.	7 Sept.	2051
	13	354	Tues.	24 Sept.	2052
	14	385	Sat.	13 Sept.	2053
307 Cycle.	5815	355	Sat.	3 Oct.	2054
	16	354	Thur.	23 Sept.	2055
	17	383	Mon.	11 Sept.	2056
	18	355	Sat.	29 Sept.	2057
	19	354	Thur.	19 Sept.	2058
	20	383	Mon.	8 Sept.	2059
	21	355	Sat.	25 Sept.	2060
	22	385	Thur.	15 Sept.	2061
	23	354	Thur.	5 Oct.	2062
	24	353	Mon.	24 Sept.	2063
	25	385	Thur.	11 Sept.	2064
	26	354	Thur.	1 Oct.	2065
	27	355	Mon.	20 Sept.	2066
	28	383	Sat.	10 Sept.	2067
	29	354	Thur.	27 Sept.	2068
	30	355	Mon.	16 Sept.	2069
	31	383	Sat.	6 Sept.	2070
	32	355	Thur.	24 Sept.	2071
	33	384	Tues.	13 Sept.	2072

MAHOMETAN CALENDAR.

The Mahometan era, or era of the Hegira, employed in Turkey, Persia, Arabia, &c., is dated from the flight of Mahomet from Mecca to Medina, which was in the night of Thursday the 15th of July, A.D. 622, and it commenced on the day following. The years of the Hegira are purely lunar, and always consist of twelve lunar months commencing with the approximate new moon, without any intercalation to keep them to the same season with respect to the Sun, so that they retrograde through all the seasons in about $32\frac{1}{2}$ years. They are also partitioned into cycles of 30 years, 19 of which are common years of 354 days each, and the other 11 are intercalary years having an additional day appended to the last month. The mean length of the year is therefore $354\frac{11}{30}$ days or 354 days 8 hours 48 min., which divided by 12 gives $29\frac{19}{30}\frac{1}{0}$ days or 29 days 12 hours 44 min. as the time of a mean lunation, and this differs from the astronomical mean lunation by only 3 seconds. This small error will not amount to a day in less than 2300 years.

To find if a year is intercalary or common, divide it by 30; the quotient will be the number of completed cycles and the remainder will be the year of the current cycle; if this last be one of the numbers 2, 5, 7, 10, 13, 16, 18, 21, 24, 26, 29, the year is intercalary and consists of 355 days; if it be any other number, the year is ordinary.

Or if Y denote the number of the year, and

$$R = \left(\frac{11\,Y + 14}{30}\right)_r;$$

the year is intercalary when $R < 11$.

Also the number of intercalary years from the year 1 up to the year Y inclusive $= \left(\frac{11\,Y + 14}{30}\right)_w$; and the same, exclusive of the year Y, $= \left(\frac{11\,Y + 3}{30}\right)_w$.

To find the day of the week on which any year of the Hegira begins, we observe that the year 1 began on a Friday, and that after every common year of 354 days, or 50 weeks and 4 days, the day of the week must necessarily become postponed 4 days, besides the additional day of each intercalary year.

Hence if $w = 1$ indicate Sun.	2 Mon.	3 Tues.	4 Wed.	5 Thur.	6 Frid.	7 Sat.

the day of the week on which the year Y commences will be

$$w = 2 + 4\left(\frac{Y}{7}\right)_r + \left(\frac{11\,Y+3}{30}\right)_w \text{ (rejecting sevens);}$$

which admits of being reduced to the more convenient formula

$$w = 7 - \left(\frac{Y}{7}\right)_r + 3\left(\frac{11\,Y+3}{30}\right)_r \text{ (rejecting sevens),}$$

the values of which obviously circulate in a period of 7 times 30 or 210 years.

Let C denote the number of completed cycles, and y the year of the cycle; then $Y = 30\,C + y$, and

$$w = 5\left(\frac{C}{7}\right)_r + 6\left(\frac{y}{7}\right)_r + 3\left(\frac{11\,y+3}{30}\right)_r \text{ (rejecting sevens).}$$

From this formula the following table has been constructed:—

Year of the Current Cycle (y).				Number of the Period of Seven Cycles $= \left(\frac{C}{7}\right)_r$						
				0	1	2	3	4	5	6
0	8			Mon.	Sat.	Thur.	Tues.	Sun.	Frid.	Wed.
1	9	17	25	Frid.	Wed.	Mon.	Sat.	Thur.	Tues.	Sun.
*2	*10	*18	*26	Tues.	Sun.	Frid.	Wed.	Mon.	Sat.	Thur.
3	11	19	27	Sun.	Frid.	Wed.	Mon.	Sat.	Thur.	Tues.
4	12	20	28	Thur.	Tues.	Sun.	Frid.	Wed.	Mon.	Sat.
*5	*13	*21	*29	Mon.	Sat.	Thur.	Tues.	Sun.	Frid.	Wed.
6	14	22	30	Sat.	Thur.	Tues.	Sun.	Frid.	Wed.	Mon.
*7	15	23		Wed.	Mon.	Sat.	Thur.	Tues.	Sun.	Frid.
	*16	*24		Sun.	Frid.	Wed.	Mon.	Sat.	Thur.	Tues.

To find from this table the day of the week on which any year of the Hegira commences, the rule to be observed will be as follows :—

Rule.—Divide the year of the Hegira by 30; the quotient is the number of cycles, and the remainder is the year of the current cycle. Next divide the number of cycles by 7, and the second remainder will be the Number of the Period, which being found at the top of the table, and the year of the cycle on the left hand, the required day of the week is immediately shown.

The intercalary years of the cycle are distinguished by an asterisk.

For the computation of the Christian date, the ratio of a mean year of the Hegira to a solar year is

$$\frac{\text{Year of Hegira}}{\text{Mean solar year}} = \frac{354\frac{11}{30}}{365{\cdot}24222} = 0{\cdot}970224.$$

The year 1 began 16 July, 622, Old Style, or 19 July, 622, according to the New or Gregorian Style. Now the day of the year answering to the 19th of July is 200 which, in parts of the solar year, is 0·5476, and the number of years elapsed $= Y - 1$. Therefore, as the intercalary days are distributed with considerable regularity in both calendars, the date of commencement of the year Y expressed in Gregorian years is

$$0{\cdot}970224\ (Y-1) + 622{\cdot}5476,$$
$$\text{or } 0{\cdot}970224\ Y + 621{\cdot}5774.$$

This formula gives the following rule for calculating the date of the commencement of any year of the Hegira, according to the Gregorian or New Style.

Rule.—Multiply 970224 by the year of the Hegira, cut off six decimals from the product, and add 621·5774. The

sum will be the year of the Christian era, and the day of the year will be found by multiplying the decimal figures by 365.

The result may sometimes differ a day from the truth as the intercalary days do not occur simultaneously; but as the day of the week can always be accurately obtained from the foregoing table, the error, if any, can be readily adjusted.

Example.—Required the date on which the year 1362 of the Hegira begins.

970224
1362
1940448
5821344
2910672
970224
1321·445088
621·5774
1943·0225
365
1125
1350
675
8·2125

Thus the date is the 8th day, or 8 January, of the year 1943.

To find, as a test, the accurate day of the week, the proposed year of the Hegira divided by 30 gives 45 cycles and remainder 12, the year of the current cycle.

Also 45 divided by 7 leaves a remainder 3 for the number of the period.

Therefore, referring to 3 at the top of the table and 12 on the left, the required day is Friday.

The tables, pages 154-5, show that 8 Jan. 1943 is a Friday; therefore the date is exact.

For any other date of the Mahometan year it is only requisite to know the names of the consecutive months, and the length of each; these are,

Muharram . . .	30	Shaaban . . .	29
Saphar	29	Ramadân . . .	30
Rabia I.	30	Shawall	29
Rabia II. . . .	29	Dulkaada . . .	30
Jomada I. . . .	30	Dulheggia . . .	29
Jomada II. . . .	29	and, in intercalary	
Rajab	30	years, 30 days.	

The ninth month, Ramadân, is the month of Abstinence observed by the Turks.

The Turkish calendar may evidently be carried on indefinitely by successive addition, observing only to allow for the additional day that occurs in the bissextile and intercalary years; but for any remote date the computation according to the preceding rules will be most efficient, and such computation may be usefully employed as a check on the accuracy of any considerable extension of the calendar by induction alone.

The following table shows the dates of commencement of Mahometan years for 1845 up to 2047, or from the 43rd to the 49th cycle inclusive, which form the whole of the seventh period of seven cycles. Throughout the next period of seven cycles, and all other like periods, the days of the week will recur in exactly the same order.

All the tables hitherto published, of this kind, which extend beyond the year 1900 of the Christian era, are erroneous, not excepting the celebrated French work, *L'Art de vérifier les Dates*, so justly regarded as the greatest authority in chronological matters. The errors have probably arisen from a continued excess of 10 in the discrimination of the intercalary years, and they have been faithfully transcribed by other authors.

Table of MAHOMETAN YEARS.

43rd Cycle.				44th Cycle.			
Year of Hegira.	Commencement (1st of Muharram).			Year of Hegira.	Commencement (1st of Muharram).		
1261	Frid.	10 Jan.	1845	1291	Wed.	18 Feb.	1874
1262*	Tues.	30 Dec.	1845	1292*	Sun.	7 Feb.	1875
1263	Sun.	20 Dec.	1846	1293	Frid.	28 Jan.	1876
1264	Thur.	9 Dec.	1847	1294	Tues.	16 Jan.	1877
1265*	Mon.	27 Nov.	1848	1295*	Sat.	5 Jan.	1878
1266	Sat.	17 Nov.	1849	1296	Thur.	26 Dec.	1878
1267*	Wed.	6 Nov.	1850	1297*	Mon.	15 Dec.	1879
1268	Mon.	27 Oct.	1851	1298	Sat.	4 Dec.	1880
1269	Frid.	15 Oct.	1852	1299	Wed.	23 Nov.	1881
1270*	Tues.	4 Oct.	1853	1300*	Sun.	12 Nov.	1882
1271	Sun.	24 Sept.	1854	1301	Frid.	2 Nov.	1883
1272	Thur.	13 Sept.	1855	1302	Tues.	21 Oct.	1884
1273*	Mon.	1 Sept.	1856	1303*	Sat.	10 Oct.	1885
1274	Sat.	22 Aug.	1857	1304	Thur.	30 Sept.	1886
1275	Wed.	11 Aug.	1858	1305	Mon.	19 Sept.	1887
1276*	Sun.	31 July	1859	1306*	Frid.	7 Sept.	1888
1277	Frid.	20 July	1860	1307	Wed.	28 Aug.	1889
1278*	Tues.	9 July	1861	1308*	Sun.	17 Aug.	1890
1279	Sun.	29 June	1862	1309	Frid.	7 Aug.	1891
1280	Thur.	18 June	1863	1310	Tues.	26 July	1892
1281*	Mon.	6 June	1864	1311*	Sat.	15 July	1893
1282	Sat.	27 May	1865	1312	Thur.	5 July	1894
1283	Wed.	16 May	1866	1313	Mon.	24 June	1895
1284*	Sun.	5 May	1867	1314*	Frid.	12 June	1896
1285	Frid.	24 April	1868	1315	Wed.	2 June	1897
1286*	Tues.	13 April	1869	1316*	Sun.	22 May	1898
1287	Sun.	3 April	1870	1317	Frid.	12 May	1899
1288	Thur.	23 Mar.	1871	1318	Tues.	1 May	1900
1289*	Mon.	11 Mar.	1872	1319*	Sat.	20 April	1901
1290	Sat.	1 Mar.	1873	1320	Thur.	10 April	1902

Table of Mahometan Years.

45th Cycle.				46th Cycle.			
Year of Hegira.	Commencement (1st of Muharram).			Year of Hegira.	Commencement (1st of Muharram).		
1321	Mon.	30 Mar.	1903	1351	Sat.	7 May	1932
1322*	Frid.	18 Mar.	1904	1352*	Wed.	26 April	1933
1323	Wed.	8 Mar.	1905	1353	Mon.	16 April	1934
1324	Sun.	25 Feb.	1906	1354	Frid.	5 April	1935
1325*	Thur.	14 Feb.	1907	1355*	Tues.	24 Mar.	1936
1326	Tues.	4 Feb.	1908	1356	Sun.	14 Mar.	1937
1327*	Sat.	23 Jan.	1909	1357*	Thur.	3 Mar.	1938
1328	Thur.	13 Jan.	1910	1358	Tues.	21 Feb.	1939
1329	Mon.	2 Jan.	1911	1359	Sat.	10 Feb.	1940
1330*	Frid.	22 Dec.	1911	1360*	Wed.	29 Jan.	1941
1331	Wed.	11 Dec.	1912	1361	Mon.	19 Jan.	1942
1332	Sun.	30 Nov.	1913	1362	Frid.	8 Jan.	1943
1333*	Thur.	19 Nov.	1914	1363*	Tues.	28 Dec.	1943
1334	Tues.	9 Nov.	1915	1364	Sun.	17 Dec.	1944
1335	Sat.	28 Oct.	1916	1365	Thur.	6 Dec.	1945
1336*	Wed.	17 Oct.	1917	1366*	Mon.	25 Nov.	1946
1337	Mon.	7 Oct.	1918	1367	Sat.	15 Nov.	1947
1338*	Frid.	26 Sept.	1919	1368*	Wed.	3 Nov.	1948
1339	Wed.	15 Sept.	1920	1369	Mon.	24 Oct.	1949
1340	Sun.	4 Sept.	1921	1370	Frid.	13 Oct.	1950
1341*	Thur.	24 Aug.	1922	1371*	Tues.	2 Oct.	1951
1342	Tues.	14 Aug.	1923	1372	Sun.	21 Sept.	1952
1343	Sat.	2 Aug.	1924	1373	Thur.	10 Sept.	1953
1344*	Wed.	22 July	1925	1374*	Mon.	30 Aug.	1954
1345	Mon.	12 July	1926	1375	Sat.	20 Aug.	1955
1346*	Frid.	1 July	1927	1376*	Wed.	8 Aug.	1956
1347	Wed.	20 June	1928	1377	Mon.	29 July	1957
1348	Sun.	9 June	1929	1378	Frid.	18 July	1958
1349*	Thur.	29 May	1930	1379*	Tues.	7 July	1959
1350	Tues.	19 May	1931	1380	Sun.	26 June	1960

Table of MAHOMETAN YEARS.

47th Cycle.				48th Cycle.			
Year of Hegira.	Commencement (1st of Muharram).			Year of Hegira.	Commencement (1st of Muharram).		
1381	Thur.	15 June	1961	1411	Tues.	24 July	1990
1382*	Mon.	4 June	1962	1412*	Sat.	13 July	1991
1383	Sat.	25 May	1963	1413	Thur.	2 July	1992
1384	Wed.	13 May	1964	1414	Mon.	21 June	1993
1385*	Sun.	2 May	1965	1415*	Fri.	10 June	1994
1386	Frid.	22 April	1966	1416	Wed.	31 May	1995
1387*	Tues.	11 April	1967	1417*	Sun.	19 May	1996
1388	Sun.	31 Mar.	1968	1418	Frid.	9 May	1997
1389	Thur.	20 Mar.	1969	1419	Tues.	28 April	1998
1390*	Mon.	9 Mar.	1970	1420*	Sat.	17 April	1999
1391	Sat.	27 Feb.	1971	1421	Thur.	6 April	2000
1392	Wed.	16 Feb.	1972	1422	Mon.	26 Mar.	2001
1393*	Sun.	4 Feb.	1973	1423*	Frid.	15 Mar.	2002
1394	Frid.	25 Jan.	1974	1424	Wed.	5 Mar.	2003
1395	Tues.	14 Jan.	1975	1425	Sun.	22 Feb.	2004
1396*	Sat.	3 Jan.	1976	1426*	Thur.	10 Feb.	2005
1397	Thur.	23 Dec.	1976	1427	Tues.	31 Jan.	2006
1398*	Mon.	12 Dec.	1977	1428*	Sat.	20 Jan.	2007
1399	Sat.	2 Dec.	1978	1429	Thur.	10 Jan.	2008
1400	Wed.	21 Nov.	1979	1430	Mon.	29 Dec.	2008
1401*	Sun.	9 Nov.	1980	1431*	Frid.	18 Dec.	2009
1402	Frid.	30 Oct.	1981	1432	Wed.	8 Dec.	2010
1403	Tues.	19 Oct.	1982	1433	Sun.	27 Nov.	2011
1404*	Sat.	8 Oct.	1983	1434*	Thur.	15 Nov.	2012
1405	Thur.	27 Sept.	1984	1435	Tues.	5 Nov.	2013
1406*	Mon.	16 Sept.	1985	1436*	Sat.	25 Oct.	2014
1407	Sat.	6 Sept.	1986	1437	Thur.	15 Oct.	2015
1408	Wed.	26 Aug.	1987	1438	Mon.	3 Oct.	2016
1409*	Sun.	14 Aug.	1988	1439*	Frid.	22 Sept.	2017
1410	Frid.	4 Aug.	1989	1440	Wed.	12 Sept.	2018

Table of Mahometan Years.

49th Cycle.

Year of Hegira.	Commencement (1st of Muharram).		Year of Hegira.	Commencement (1st of Muharram).	
1441	Sun.	1 Sept. 2019	1456*	Tues	21 Mar. 2034
1442*	Thur.	20 Aug. 2020	1457	Sun.	11 Mar. 2035
1443	Tues.	10 Aug. 2021	1458*	Thur.	28 Feb. 2036
1444	Sat.	30 July 2022	1459	Tues.	17 Feb. 2037
1445*	Wed.	19 July 2023	1460	Sat.	6 Feb. 2038
1446	Mon.	8 July 2024	1461*	Wed.	26 Jan. 2039
1447*	Frid.	27 June 2025	1462	Mon.	16 Jan. 2040
1448	Wed.	17 June 2026	1463	Frid.	4 Jan. 2041
1449	Sun.	6 June 2027	1464*	Tues.	24 Dec. 2041
1450*	Thur.	25 May 2028	1465	Sun.	14 Dec. 2042
1451	Tues.	15 May 2029	1466*	Thur.	3 Dec. 2043
1452	Sat.	4 May 2030	1467	Tues.	22 Nov. 2044
1453*	Wed.	23 April 2031	1468	Sat.	11 Nov. 2045
1454	Mon.	12 April 2032	1469*	Wed.	31 Oct. 2046
1455	Frid.	1 April 2033	1470	Mon.	21 Oct. 2047

Table of Epochs *of the* Principal Eras and Periods.

Name.	Christian Date of Commencement.	Name.	Christian Date of Commencement.
Grecian Mundane era	1 Sept 5593 B.C.	Sidonian era . .	Oct. 110 B.C.
Civil era of Constantinople .	1 Sept. 5508 ,,	Cæsarean era of Antioch . .	1 Sept. 48 ,,
Alexandrian era .	29 Aug. 5502 ,,	Julian year . .	1 Jan. 45 ,,
Ecclesiastical era of Antioch .	1 Sept. 5492 ,,	Spanish era . .	1 Jan. 38 ,,
Julian Period .	1 Jan. 4713 ,,	Actian era . .	1 Jan. 30 ,,
Mundane era .	Oct. 4008 ,,	Augustan era .	14 Feb. 27 ,,
Jewish Mundane era	Oct. 3761 ,,	Vulgar Christian era	1 Jan. 1 A.D.
Era of Abraham	1 Oct. 2015 ,,	Destruction of Jerusalem . .	1 Sept. 69 ,,
Era of the Olympiads . . .	1 July 776 ,,	Era of Maccabees	24 Nov. 166 ,,
Roman era . .	24 April 753 ,,	,, ,, Dioclesian	17 Sept. 284 ,,
Era of Nabonassar	26 Feb. 747 ,,	,, ,, Ascension	12 Nov. 295 ,,
Metonic Cycle .	15 July 432 ,,	,, ,, the Armenians . . .	7 July 552 ,,
Grecian or Syro-Macedonian era	1 Sept. 312 ,,	Mahometan era of the Hegira .	16 July 622 ,,
Tyrian era . .	19 Oct. 125 ,,	Persian era of Yezdegird . . .	16 June 632 ,,

Cambridge University Terms, after 1883.

Up to the end of the year 1883 the Cambridge University Terms were, in substance, determined by the process we briefly formulated on page 178. About that time a new scheme was recommended by the Council of the Senate and ordered to be adopted for all subsequent years. In order to bring this new scheme into the most convenient practical use it is here formulated in like manner, and made to depend on the number of direction :—

Commencement, Tuesday *before* Midsummer.

Lent Term begins Jan. 8, ends

N=				
1 .. 9	March	(N + 18)		
10 .. 26	,,	27		
27 .. 35	,,	(N + 1)		

Easter Term begins

N=				
1 .. 9	April	(N + 9)		
10 .. 26	,,	18		
27 .. 35	,,	(N − 8)		

ends June 24.

Michaelmas Term begins October 1, ends December 19.

From Lent Term ends to Easter Term begins } = 22 days.

An improved Table for finding the date of Easter Day is given overleaf. By its use the Table of Epacts on page 164 is not wanted, and the operations require less consideration.

EASTER-DAY *found from the* GOLDEN

Epact.	1500 1600	1700 1800	1900 2000 2100	2200 2400	2300 2500	2600 2700 2800	2900 3000	3100 3200 3300	3400 3600	3500 3700	3800 3900 4000
*		1	12		4	15		7	18		10
1	1	12		4	15		7	18		10	
2	12		4	15		7	18		10		2
3		4	15		7	18		10		2	13
4	4	15		7	18		10		2	13	
5	15		7	18		10		2	13		5
6		7	18		10		2	13		5	16
7	7	18		10		2	13		5	16	
8	18		10		2	13		5	16		8
9		10		2	13		5	16		8	19
10	10		2	13		5	16		8	19	
11		2	13		5	16		8	19		11
12	2	13		5	16		8	19		11	
13	13		5	16		8	19		11		3
14		5	16		8	19		11		3	14
15	5	16		8	19		11		3	14	
16	16		8	19		11		3	14		6
17		8	19		11		3	14		6	17
18	8	19		11		3	14		6	17	
19	19		11		3	14		6	17		9
20		11		3	14		6	17		9	
21	11		3	14		6	17		9		1
22		3	14		6	17		9		1	12
23	3	14		6	17		9		1	12	
24			6			9		1			4
25	14	6		17	9		1		12	4	
26	6	17	17	9		1	12	12	4	15	15
27	17		9		1	12		4	15		7
28		9		1	12		4	15		7	18
29	9		1	12		4	15		7	18	

Directions.—Under the century find the golden number; Dominical Letter the date of Easter Day is shown.

NUMBER *and* DOMINICAL LETTER *only*.

	Dominical Letter. (For Leap Years use the *second* letter).						
	A	B	C	D	E	F	G
	Apr. 16	Apr. 17	Apr. 18	Apr. 19	Apr. 20	Apr. 14	Apr. 15
	,, 16	,, 17	,, 18	,, 19	,, 13	,, 14	,, 15
	,, 16	,, 17	,, 18	,, 12	,, 13	,, 14	,, 15
	,, 16	,, 17	,, 11	,, 12	,, 13	,, 14	,, 15
	,, 16	,, 10	,, 11	,, 12	,, 13	,, 14	,, 15
	,, 9	,, 10	,, 11	,, 12	,, 13	,, 14	,, 15
	,, 9	,, 10	,, 11	,, 12	,, 13	,, 14	,, 8
	,, 9	,, 10	,, 11	,, 12	,, 13	,, 7	,, 8
	,, 9	,, 10	,, 11	,, 12	,, 6	,, 7	,, 8
	,, 9	,, 10	,, 11	,, 5	,, 6	,, 7	,, 8
	,, 9	,, 10	,, 4	,, 5	,, 6	,, 7	,, 8
	,, 9	,, 3	,, 4	,, 5	,, 6	,, 7	,, 8
	,, 2	,, 3	,, 4	,, 5	,, 6	,, 7	,, 8
	,, 2	,, 3	,, 4	,, 5	,, 6	,, 7	,, 1
	,, 2	,, 3	,, 4	,, 5	,, 6	Mar. 31	,, 1
	,, 2	,, 3	,, 4	,, 5	Mar. 30	,, 31	,, 1
	,, 2	,, 3	,, 4	Mar. 29	,, 30	,, 31	,, 1
	,, 2	,, 3	Mar. 28	,, 29	,, 30	,, 31	,, 1
	,, 2	Mar. 27	,, 28	,, 29	,, 30	,, 31	,, 1
	Mar. 26	,, 27	,, 28	,, 29	,, 30	,, 31	,, 1
	,, 26	,, 27	,, 28	,, 29	,, 30	,, 31	Mar. 25
	,, 26	,, 27	,, 28	,, 29	,, 30	,, 24	,, 25
	,, 26	,, 27	,, 28	,, 29	,, 23	,, 24	,, 25
	,, 26	,, 27	,, 28	,, 22	,, 23	,, 24	,, 25
	Apr. 23	Apr. 24	Apr. 25	Apr. 19	Apr. 20	Apr. 21	Apr 22
	,, 23	,, 24	,, 25	,, 19	,, 20	,, 21	,, 22
	,, 23	,, 24	,, 18	,, 19	,, 20	,, 21	,, 22
	,, 23	,, 17	,, 18	,, 19	,, 20	,, 21	,, 22
	,, 16	,, 17	,, 18	,, 19	,, 20	,, 21	,, 22
	,, 16	,, 17	,, 18	,, 19	,, 20	,, 21	,, 15

then on the same horizontal line and under the
The Epact is also shown on the left in the first column.

APPENDIX.

The valuable miscellaneous information conveyed in what follows has for the most part been obtained from the Reports by the Board of Trade on their proceedings and business under the Weights and Measures Act, 1878. This is regarded as the principal Act in relation to weights and measures, and its chief enactments have already been briefly stated on pages 26-8, 50 and 53.

Imperial weights and measures are now legally in force in the following colonies, &c. :—

Antigua.	Jamaica.	Singapore.
Barbadoes.	Malta.	South Australia.
Bermuda.	Natal.	St. Christopher.
British Guiana.	Nevis.	St. Helena.
British Honduras.	New Brunswick.	St. Vincent.
Canada.	New South Wales.	Tobago.
Cape of Good Hope.	New Zealand.	Trinidad.
Cyprus.	Nova Scotia.	Vancouver's Island.
Dominica.	Queensland.	Victoria.
Grenada.	Sierra Leone.	Western Australia.
Hong Kong.		

In Germany, by a law promulgated on 11th July, 1884, it was declared that the "meter" was then to be adopted as the basis of all weight and measure, and that the weight of distilled water contained in a cubic decimeter, in a vacuum at the temperature of 4° centigrade, was to be the unit of weight, a "kilogramm."

On this metric basis the other values of the French metric system (pp. 75-6) were likewise adopted, and under all but identical denominations. The several parts and

multiples, including the half and quarter, of these metric denominations were also to be used.

CHINA.

Weights and Measures legally in use.

The subject of the legal use of weights and measures in China is attended with some difficulty, as each shopkeeper recognises no standard but his own, and the Penal Code is only strictly enforced in matters affecting the revenue. To provide against abuses certain to arise, the framers of the various foreign Treaties usually inserted clauses defining the values of the units of length and weight. In the list these Treaty equivalents are given wherever they exist.

Linear Measure.

		ENGLISH VALUE.
10 fên (lines)	= 1 ts'un ('punto,' or inch)	1·41 inches
10 ts'un	= 1 ch'ih ('covid,' or foot)	14·1 ,,
10 ch'ih	= 1 chang (rod)	141 ,,
10 chang	= 1 yin	1410 ,,
Ch'ih of the Board of Works		12·5 ,,

Itinerary Measure.

5 ch'ih ('covids')	= 1 pu* (pace)	about 66 inches
360 pu	= 1 li	,, 660 yards
10 li	= 1 t'ang-hsün	,, 6600 ,,
250 li	= 1 tu (or degree)	,, 94 miles

Land Measure.

5 ch'ih ('covids')	= 1 kung (bow)	about 66 inches
2 kung	= 1 chang	,, 11 feet
1 square chang	= 1 ching	,, 121 sq. feet
15 ching	= 1 chüo	,, 1815 ,,
4 chüo	= *mou*	,, 7260 ,,

Cubic Measure.

100 cubic ch'ih ('covids')	= 1 fang or ma	about 113 cubic feet

* The *pu* or *pace* is here estimated to be the distance from right foot-print to right foot-print of a man walking steadily; sometimes it has half this value, and then it represents the more familiar distance from right foot-print to left foot-print.

Capacity.

		ENGLISH VALUE.
2 yo	= 1 ho (gill)	about 0·2 pint
10 ho (gills)	= 1 shêng (pint)	,, 2 pints
10 shêng	= 1 *tou* (peck)	,, 20 ,,
5 tou	= 1 hu (bushel)	,, 100 ,,

The number of *tou* in a *hu* varies.

Weight Avoirdupois.

24 chu	= 1 liang	$1\frac{1}{3}$ oz. av.
16 liang ('taels,' or ounces)	= 1 chin ('catty')	$1\frac{1}{3}$ lbs.
100 chin ('catties')	= 1 tan ('picul')	$133\frac{1}{3}$,,

Silver Weight.

10 ssŭ	= 1 hao (thousandths)	·0001$\dot{3}$ oz. av.
10 hao	= 1 li (hundredths—'cash')	·001$\dot{3}$,,
10 li	= 1 fên (tenth—'candreen')	·01$\dot{3}$,,
10 fên	= 1 ch'ien ('mace')	·1$\dot{3}$,,
10 ch'ien	= 1 *liang* ('tael')	1·$\dot{3}$,,

JAPAN.

Weights and Measures legally in use.

Artisan's Measure.

10 Shi	= 1 Mo	·001193 inch
10 Mo	= 1 Rin	·01193 ,,
10 Rin	= 1 Bu	·1193 ,,
10 Bu	= 1 Sun	1·1931 ,,
10 Sun	= 1 Shaku*	11·9305 inches
10 Shaku	= 1 Jô	9·9421 feet

Dry Goods Measure.

(One-fourth more than Artisan's Measure.)

10 Rin	= 1 Bu	·14913 inch
10 Bu	= 1 Sun	1·4913 ,,
10 Sun	= 1 Shaku	14·9132 inches
10 Shaku	= 1 Jô	12·4276 feet

Itinerary Measure.

6 Shaku = 1 Ken	5·9653 feet
60 Ken = 1 Chô	357·9163 ,,
36 Chô = 1 Ri	4295 yards, or 2·4403 miles
Kai-Ri, or Sea Mile = 16·975 Chô	2025 ,, 1·1506 ,,

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* The shaku = $\frac{10}{33}$ mètre.

Superficial or Land Measure.

		ENGLISH VALUE.
36 square Shaku	= 1 Tsubo	3·9538 square yards
30 Tsubo	= 1 Se	118·6149 ,,
10 Se	= 1 Tan	39·2115 square poles
10 Tan	= 1 Chō	2·4507 acres

Capacity.

10 Kei	= 1 Sai	·000318 pint.
10 Sai	= 1 Shō	·003176 ,,
10 Shō	= 1 Shaku	·03176 ,,
10 Shaku	= 1 Gō	·3176 ,,
10 Gō	= 1 Shō	1·5881 quarts.
10 Shō	= 1 To	3·9703 gallons.
10 To	= 1 Koku	4·9629 bushels.

Weight.

10 Shi	= 1 Mo	·05797 grain.
10 Mo	= 1 Rin	·5797 ,,
10 Rin	= 1 Fun	5·7972 grains.
10 Fun	= 1 Momme	57·972 ,,
100 Momme	= 1 Hyaku-me	0·8282 lbs. av.
1000 Momme	= 1 Kwam-me	8·2817 ,,
160 Momme	= 1 Kin	1·3251 ,,
100 Kin	= 1 Hiyak-kin	132·5073 ,,

The Imperial Standard Yard.—An accurate copy ("P. C. VI."), of the same form and material as the Imperial Standard Yard, has been made, as required by the Act, 1878. No two primary standards are really alike, but these two primary standards are as much alike as it is possible to make them. (Standards Office, 10th July, 1886.)

The Indian Seer.—A question having arisen as to the true weight of the Indian seer to be marked on weighing-machines, the information given by the Board of Trade was that the seer of the British Government is equal to 80 tolos, or to 32·914 ounces avoirdupois, the tola, the legal weight of the rupee, being equal to 180 grains.

Illegal Denominations of Weight.—There are no Board of Trade standards of 3, 5, 6, 8, 9, 10, or 11 lbs., and the use in trade of weights of these denominations would appear, therefore, to be illegal, as the inspectors could not stamp them.

Wire and Sheet Gauges.

The wire manufacturer has his special instrument, the wire gauge, for accurately measuring the diameter of the wire he draws. This gauge is generally a rectangular steel plate, having around its edges a series of notches graduated to all the sizes required. Up to a recent date the greatest confusion existed in the free use of wire and metal gauges, the various sizes of which were of a very promiscuous character; indeed, the gauges most generally used were severally known by the common appellation of the Birmingham Wire Gauge (B. W. G.). Yet there were many varieties all bearing this name and differing materially from each other, almost every firm, in the absence of a definite standard, being accustomed to employ its own gauge as the correct one. Also wire-drawers as a body were, in consequence thereof, less careful, knowing that disputes could not be settled by gauges.

But since the establishment of telegraphy and self-acting machines for working wires into nails, pins, rivets, screws, &c., exactitude both in diameter and "cast" have become indispensable, and the wire manufacturer's ingenuity is being strained to meet the increasing demands for wires having accurate diameters, and, as a check, weighing so much per given length.

The necessities of some trades require an extended series of sizes with small differences between them; others a smaller series with greater differences; while some, again, deal only with the thicker sizes, and others only with the finer. An effective standard gauge should be sufficiently comprehensive to include all these purposes, so that the sizes of any special trade may be obtained from it, although only a portion of such standard be used. The standard gauge should, therefore, have a large range of sizes from which each trade may select such as may suit it, or it may consist of a more limited series of primary sizes readily

divisible into half and quarter sizes, according to the very convenient arrangement adopted in the construction of the gauge patented by Mr. Hughes.

Imperial Standard Wire Gauge.

The serious complications often arising from the use of so many different wire gauges have been effectually remedied by the recent introduction of a standard wire gauge by the Board of Trade. It is designated the Imperial Standard Wire Gauge, and was legalised by an Order in Council of 23rd August, 1883, and came into operation as the only legal wire gauge on 1st March, 1884. From and after that date it therefore became necessary to use in trade the particular equivalent sizes in parts of an inch, from 0·500 to 0·001 inch, as stated in the Order referred to.

The Weights and Measures Act of 1878 specially provides that a contract or dealing shall not be invalid or open to objection on the ground that the weights or measures expressed or referred to therein are weights and measures of the metric system.

The Order in Council, by which the new gauge is legalised, does not alter or amend this law, and contracts for wire, &c., may continue, therefore, to be made in millimètres, or other metric measures as above provided.

The following table contains all the measurements represented, or intended to be represented, by the said Imperial Standard Wire Gauge, together with the equivalents expressed in millimètres:—

TABLE I.

IMPERIAL STANDARD WIRE GAUGE.

Number of Standard Gauge.	Diameter.		Number of Standard Gauge.	Diameter.	
	In parts of an inch.	In millimètres.		In parts of an inch.	In parts of millimètres.
No.	Inch.	Millimètres.	No.	Inch.	Millimètre.
7·0	0·500	12·700	23	0·024	0·610
6·0	·464	11·785	24	·022	·559
5·0	·432	10·973	25	·020	·508
4·0	·400	10·160	26	·018	·457
3·0	·372	9·449	27	·0164	·4166
2·0	·348	8·839	28	·0148	·3759
1·0	·324	8·229	29	·0136	·3454
1	·300	7·620	30	·0124	·3150
2	·276	7·010	31	·0116	·2946
3	·252	6·401	32	·0108	·2743
4	·232	5·893	33	·0100	·2540
5	·212	5·385	34	·0092	·2337
6	·192	4·877	35	·0084	·2134
7	·176	4·470	36	·0076	·1930
8	·160	4·064	37	·0068	·1727
9	·144	3·658	38	·0060	·1524
10	·128	3·251	39	·0052	·1321
11	·116	2·946	40	·0048	·1219
12	·104	2·642	41	·0044	·1118
13	·092	2·337	42	·0040	·1016
14	·080	2·032	43	·0036	·0914
15	·072	1·829	44	·0032	·0813
16	·064	1·626	45	·0028	·0711
17	·056	1·422	46	·0024	·0610
18	·048	1·219	47	·0020	·0508
19	·040	1·016	48	·0016	·0406
20	·036	0·914	49	·0012	·0305
21	·032	·813	50	0·0010	0·0254
22	·028	·711			

To make the standard wire-gauge additionally useful as a plate-gauge, Table II. has been calculated, showing the corresponding weight in pounds avoirdupois of each superficial square foot of metal plate.

TABLE II.

Showing the weight of a *superficial square foot* of wrought iron for all thicknesses of the IMPERIAL STANDARD WIRE GAUGE.

At 62° Fahr.

Density—7·8; Weight of cubic inch of water=252·458 grains.

Descriptive Number.	Weight of Square Foot.	Descriptive Number.	Weight of Square Foot.
No.	lbs.	No.	lbs.
7·0	20·254	23	0·972
6·0	18·796	24	·891
5·0	17·500	25	·810
4·0	16·203	26	·729
3·0	15·069	27	·664
2·0	14·097	28	·600
1·0	13·125	29	·551
1	12·153	30	·502
2	11·180	31	·470
3	10·208	32	·437
4	9·398	33	·405
5	8·588	34	·373
6	7·778	35	·340
7	7·130	36	·308
8	6·481	37	·275
9	5·833	38	·243
10	5·185	39	·211
11	4·699	40	·194
12	4·213	41	·178
13	3·727	42	·162
14	3·241	43	·146
15	2·917	44	·130
16	2·593	45	·113
17	2·268	46	·097
18	1·944	47	·081
19	1·620	48	·065
20	1·458	49	·049
21	1·296	50	·041
22	1·134		

Tables III. and IV., which also relate to the Imperial Standard Wire Gauge, supply other important values of great practical use to engineers and others.

TABLE III.

IMPERIAL STANDARD WIRE GAUGE.

Table of Sectional Areas, Weights, Lengths, and Breaking Strains of Iron Wire; issued by the Iron and Steel Wire Manufacturers' Association.

Size on Wire Gauge.	Sectional Area in square inches.	Weight of		Length of Cwt.	Breaking Strains.	
		100 yards.	Mile.		Annealed.	Bright.
No.	inch.	lbs.	lbs.	yards.	lbs.	lbs.
7·0	·1963	193·4	3404	58	10470	15700
6·0	·1691	166·5	2930	67	9017	13525
5·0	·1466	144·4	2541	78	7814	11725
4·0	·1257	123·8	2179	91	6702	10052
3·0	·1087	107·1	1885	105	5796	8694
2·0	·0951	93·7	1649	120	5072	7608
1·0	·0824	81·2	1429	138	4397	6595
1	·0707	69·6	1225	161	3770	5655
2	·0598	58·9	1037	190	3190	4785
3	·0499	49·1	864	228	2660	3990
4	·0423	41·6	732	269	2254	3381
5	·0353	34·8	612	322	1883	2824
6	·0290	28·5	502	393	1544	2316
7	·0243	24·0	422	467	1298	1946
8	·0201	19·8	348	566	1072	1608
9	·0163	16·0	282	700	869	1303
10	·0129	12·7	223	882	687	1030
11	·0106	10·4	183	1077	564	845
12	·0085	8·4	148	1333	454	680
13	·0066	6·5	114	1723	355	532
14	·0050	5·0	88	2240	268	402
15	·0041	4·0	70	2800	218	326
16	·0032	3·2	56	3500	172	257
17	·0025	2·4	42	4667	131	197
18	·0018	1·8	32	6222	97	145
19	·0013	1·2	21	9333	67	100
20	·0010	1·0	18	11200	55	82

TABLE IV.

Table of Weights and Resistances of Copper and Iron Wire, compiled by Mr. C. H. Barney, Sec. of the National Telephone Exchange Association, New York.

Number of standard Gauge.	Pure Copper Wire.				Galvanis'd iron wire.	
	Weight, sp. gr., 8·90		Resistance at 59·9° Fahr.		Weight, sp. gr., 7·74.	Resistance at 59·9° Fahr.
	lbs. per 1000 feet.	lbs. per mile.	Ohms per 1000 feet.	Ohms per mile.	lbs. per mile.	Ohms per mile.
7·0	756·28					
6·0	651·31					
5·0	564·44					
4·0	484·03					
3·0	418·63					
2·0	366·36					
1·0	317·54	1676·61	·095774	·50558		
1	272·27	1437·58	·11171	·58982		
2	230·44	1216·72	·13199	·69690		
3	192·11	1014·34	·15832	·83592		
4	162·83	859·74	·18680	·98630	747·68	6·6884
5	135·96	717·87	·22370	1·18113	624·30	8·0100
6	111·52	588·82	·27273	1·4400	572·07	9·7656
7	93·71	494·78	·32458	1·7137	430·29	11·6222
8	77·445	408·89	·39273	2·0736	355·60	14·0625
9	62·730	331·21	·48486	2·5600	279·34	17·3611
10	49·565	261·70	·61365	3·2400	227·59	21·9726
11	40·707	214·93	·74718	3·9451	186·92	26·7539
12	32·720	172·76	·92955	4·9080	150·24	33·2840
13	25·605	135·19	1·1878	6·2715	117·57	42·5331
14	19·361	102·22	1·5709	8·2943	88·90	56·2500
15	15·683	82·80	1·9394	10·2400	72·01	69·4444
16	12·391	65·42	2·4546	12·9602	56·89	87·8906
17	9·4869		3·2060			
18	6·9700		4·3637			
19	4·8403		6·2837			
20	3·9206		7·7577			
21	3·0978		9·8184			
22	2·3708		12·824			
23	1·7425		17·455			
24	1·4642		20·773			
25	1·2100		25·135			
26	0·98015		31·031			
27	·81365		37·381			
28	·66263		45·900			
29	·55953		54·358			
30	·46515		65·388			
31	·40707		74·718			
32	·35286		86·197			
33	·30252		100·541			
34	·25605		118·79			
35	·21346		142·49			
36	·17473		174·07			
37	·13988		216·94			
38	·10891		279·28			
39	·08180		371·82			
40	·06970		436·37			

Resistance $\left(\begin{smallmatrix}\text{copper}\\ \text{iron}\end{smallmatrix}\right)$ wire increases about $\left(\begin{smallmatrix}0\,21\\ 0{\cdot}35\end{smallmatrix}\right)$ per cent. for each additional degree Fahr. The diameters of wire are already given in Table I.

Tables V., VI. and VII., which appertain to three other prominent gauges, may be of some use to those interested in the subject.

TABLE V.

STUBS' IRON WIRE GAUGE, 1879.

No.	Diameter.	No.	Diameter.	No.	Diameter.	No.	Diameter.
	Inch.		Inch.		Inch.		Inch.
4·0	·454	7	·180	17	·058	27	·016
3·0	·425	8	·165	18	·049	28	·014
2·0	·380	9	·148	19	·042	29	·013
1·0	·340	10	·134	20	·035	30	·012
1	·300	11	·120	21	·032	31	·010
2	·284	12	·109	22	·028	32	·009
3	·259	13	·095	23	·025	33	·008
4	·238	14	·083	24	·022	34	·007
5	·220	15	·072	25	·020	35	·005
6	·203	16	·065	26	·018	36	·004

Stubs' iron wire gauge has been somewhat extensively used in America and elsewhere, under the mistaken name of the Birmingham wire gauge (B.W.G.).

Table VI. is that of the Lancashire gauge for steel wire and pinion wire. It will be observed that the "letter gauge" is a continuation of the steel wire gauge.

TABLE VI.

STEEL WIRE GAUGES.

	Diameter.	No.	Diameter.	No.	Diameter.	No.	Diameter.
	Inch.		Inch.		Inch.		Inch.
Z	·413	1	·227	28	·139	55	·050
Y	·404	2	·219	29	·134	56	·045
X	·397	3	·212	30	·127	57	·042
W	·386	4	·207	31	·120	58	·041
V	·377	5	·204	32	·115	59	·040
U	·368	6	·201	33	·112	60	·039
T	·358	7	·199	34	·110	61	·038
S	·348	8	·197	35	·108	62	·037
R	·339	9	·194	36	·106	63	·036
Q	·332	10	·191	37	·103	64	·035
P	·323	11	·188	38	·101	65	·033
O	·316	12	·185	39	·099	66	·032
N	·302	13	·182	40	·097	67	·031
M	·295	14	·180	41	·095	68	·030
L	·290	15	·178	42	·092	69	·029
K	·281	16	·175	43	·088	70	·027
J	·277	17	·172	44	·085	71	·026
I	·272	18	·168	45	·081	72	·024
H	·266	19	·164	46	·079	73	·023
G	·261	20	·161	47	·077	74	·022
F	·257	21	·157	48	·075	75	·020
E	·250	22	·155	49	·072	76	·018
D	·246	23	·153	50	·069	77	·016
C	·242	24	·151	51	·066	78	·015
B	·238	25	·148	52	·063	79	·014
A	·234	26	·146	53	·058	80	·013
		27	·143	54	·055		

TABLE VII.

A Sheet and Hoop Iron Gauge issued by the South Staffordshire Ironmasters' Association for the use of sheet and hoop iron makers, 1st March, 1884.

Parts of inch.	No. on gauge.	Thickness.	Parts of inch.	No. on gauge.	Thickness.	Parts of inch.	No. on gauge.	Thickness.
1	15°	1·000		7	·1764	$\frac{1}{64}$	28	·015625
	14°	0·9583		8	·1570		29	·0139
	13°	·9167		9	·1398		30	·0123
							31	·0110
$\frac{7}{8}$	12°	·8750	$\frac{1}{8}$	10	·1250		32	·0098
	11°	·8333		11	·1113		33	·0087
	10°	·7917		12	·0991		34	·0077
				13	·0882		35	·0069
$\frac{3}{4}$	9°	·7500		14	·0785		36	·0061
	8°	·7083		15	·0699		37	·0054
	7°	·6666					38	·0048
			$\frac{1}{16}$	16	·0625		39	·0043
$\frac{5}{8}$	6°	·6250		17	·0556		40	·00386
	5°	·5883		18	·0495		41	·00343
	4°	·5416		19	·0440		42	·00306
				20	·0392		43	·00272
$\frac{1}{2}$	3°	·5000		21	·0349		44	·00242
	2°	·4452					45	·00215
	1°	·3964	$\frac{1}{32}$	22	·0312		46	·00192
	1	·3532		23	·0278		47	·00170
	2	·3147		24	·0247		48	·00152
	3	·2804		25	·0220		49	·00135
				26	·0196		50	·00120
$\frac{1}{4}$	4	·2500		27	·0174		51	·00107
	5	·2225					52	·00095
	6	·1981						

By an Order in Council, dated 26th June, 1884, it was provided that in the several places therein named the maximum fee hereafter to be taken by the local inspectors of weights and measures on the verification and stamping of wire-gauge measures should be as follows:—

Measures from 0·500 to 0·001 inch in the form of wire-gauge plates; for each notch, or for each internal gauge or separate size, from half-an-inch to one-thousandth of an inch, $0^s\ 0\frac{1}{2}^d$.

In reply to inquiries as to the use of gauges other than the new standard wire gauge, it has been stated by the Board of Trade that, in their view of the matter, a contract can only be maintained when made according to denominations of standards duly legalised under the Act. The Board have, however, no power to put an authoritative construction on the Act.

With reference to gauges used for flat metals, for sheet and hoop iron, it has been represented that a standard flat metal gauge would be desirable. The Board have, however, no power under the Act to make a standard applicable to sheet and hoop iron only. All that the Board could do, if after consideration they should think it advisable, would be to cause to be made a standard flat metal gauge applicable to any metal, whether iron, brass, tin, &c.

A new Weights and Measures Act, 1889 (52 & 53 Vict., cap. 21), came into operation on the 1st January, 1890. In the preamble the Weights and Measures Act, 1878, is referred to as the principal Act. Some of the chief enactments are in substance the following:—

1. That every weighing instrument used for trade shall be verified and stamped by an inspector of weights and measures with a stamp of verification under this Act.

2. Every person who, after twelve months from the commencement of this Act, uses, or has in his possession for use for trade, any weighing instrument not stamped as

required by this Act, shall be liable to a fine not exceeding £2, or in the case of a second offence £5;

4. And imprisonment in case of fraud.

6. The Board of Trade shall from time to time cause such new denominations of standards for the measurement of electricity, temperature, pressure, or gravities as appear to them to be required.

9. Every local authority having power to appoint inspectors of weights and measures shall, with the approval of the Board of Trade, make for the guidance of inspectors appointed or employed by that authority or person, and with the like approval, amend or rescind general regulations to be observed in the verification, stamping, and the inspection of weights, measures, and weighing and measuring instruments.

11. The Board of Trade shall provide for the holding of examinations for the purpose of ascertaining whether persons acting or appointed to act as inspectors of weights and measures possess sufficient practical knowledge for the proper performance of their duties as such, and for the grant of certificates to persons who satisfactorily pass such examinations.

20. (1) All coal shall be sold by weight only, except where by the written consent of the purchaser it is sold by boat-load, or by waggons or tubs delivered from the colliery into the works of purchaser.

(2) If any person sells coals otherwise than is required by this section he shall be liable to a fine not exceeding £5 for every such sale.

21. Weight ticket or note to be given on delivery of coal over 2 cwt.

24. Penalty, on deficiency in weight of coal on small sales, not exceeding £5.

25. Weighing instrument to be kept in place where coal is sold by retail.

27. Any seller or purchaser of coal may require that any

coal, or vehicle used for the carriage of coal in bulk, be weighed or re-weighed by a properly stamped weighing instrument.

39. This Act may be cited as the Weights and Measures Act, 1889; and the principal Act and this Act may be cited together as the Weights and Measures Acts, 1878 and 1889.

The Board of Trade, in pursuance of Section 9, have, at the commencement of the new Act, also caused to be issued a book entitled, "Model Regulations with respect to Inspectors and the Inspection of Weights, Measures, and Weighing and Measuring Instruments," which may be purchased, either directly or through any bookseller, from Messrs. Eyre & Spottiswoode, East Harding Street, E.C. The Board of Trade are prepared to approve of these regulations if made by local authorities, or to take into consideration any other or additional regulations which a local authority may desire to make for a particular district.

Every shop or place having weights, measures, or weighing instruments liable to inspection, should be visited by the inspector once at least in every year.

No weights should be stamped which are found to differ from the inspector's standards by more than the following:—

Avoirdupois weights.	Allowance in excess only.	
	Iron weights.	Brass weights.
56 lbs.	50 grains	20 grains
28 ,,	40 ,,	15 ,,
14 ,,	30 ,,	10 ,,
7 ,,	20 ,,	5 ,,
4 ,,	20 ,,	5 ,,
2 ,,	10 ,,	5 ,,
1 lb.	10 ,,	2 ,,
8 oz.	5 ,,	2 ,,
4 ,,	5 ,,	2 ,,
2 ,,	2 ,,	1 ,,
1 ,, and under	2 ,,	1 ,,

Apothecaries' Weights.	Allowance in excess only.
10, 8, or 6 oz. troy	0·5 grain
4, 2, or 1 oz. ,,	0·2 ,,
4, 2, or 1 drachms	0·1 ,,
2, 1½, 1 or ½ scruples	0·05 ,,
6, 5, 4, or 3 grains	0·02 ,,
2, 1, or ½ grains	0·01 ,,

No measures of capacity to be stamped which differ from the standards by more than the following:—

Capacity.	Liquid measure.	Dry measure.
Bushel of 8 gallons .	5 fluid ounces	20 cubic inches
Half bushel of 4 gallons	4 ,,	
Peck or 2 gallons .	3 ,,	15 ,,
Gallon . . .	2 ,,	
Half gallon . .	1 ,,	10 ,,
Quart	1 ,,	
Pint	4 fluid drachms	5 ,,
Half pint . . .	3 ,,	
Gill	2 ,,	
Half gill . . .	1 ,,	2 ,,
Quarter gill . .	½ ,,	

1 fluid ounce = 437½ grains.

On an ordinary measure of length no larger amount of error should be allowed than the following:—

	End measures.		Line measures.	
	Error in excess.	Error in deficiency.	Error in excess.	Error in deficiency.
Wood:				
Yard or foot.	$\frac{1}{16}$ in.	$\frac{1}{32}$ in.	$\frac{1}{32}$ in.	$\frac{1}{64}$ in.
Inch . .	$\frac{1}{32}$,,	$\frac{1}{32}$,,	$\frac{1}{64}$,,	$\frac{1}{64}$,,
Metal:				
Yard or foot.	0·05 in.	0·02 in.	0·02 in.	0·01 in.
Inch . .	0·02 ,,	0·01 ,,	0·005 ,,	0·002 ,,

On other measures of length such amounts of error may be allowed as the local authority may approve.

Mr. Herbage, in 1886, afforded the Standards Department an opportunity of weighing some sovereigns of the years 1864, 1865, and 1866, which he had taken from circulation:—

100 sovereigns of	the year	1864	weighed only	12,226	grains.
,,	,,	1865	,,	12,232	,,
,,	,,	1866	,,	12,232	,,

Mr. Herbage is of opinion that the "life" of a gold coin should be legally limited to a duration of twenty years.

Ascertained weights of standards used by some scale-makers for adjusting bankers' weights.

The	500	sovereigns	weight =	61,435	grains.
,,	300	,,	,,	36,861	,,
,,	200	,,	,,	24,574	,,
,,	100	,,	,,	12,287	,,
,,	50	,,	,,	6,143·5	,,
,,	30	,,	,,	3,686·1	,,
,,	20	,,	,,	2,457·4	,,
,,	10	,,	,,	1,228·7	,,
,,	5	,,	,,	614·35	,,
,,	3	,,	,,	368·61	,,
,,	2	,,	,,	245·74	,,
,,	1	,,	,,	122·87	,,
,,	½	,,	,,	61·44	,,

On pages 27-8 is given a list of standards in the custody of the Board of Trade at the time of the passing of the Act, 1878. They have now the following additional standards:—

Length: Quarter of a yard, eighth of a yard, sixteenth of a yard, and nail.
Liquid Measures: 2, 3, 4, &c., to 25 gallons.
Dry Measure: 4 bushels.
Weight: Cental or 100 lbs.; 480 grains or 20 pennyweights.

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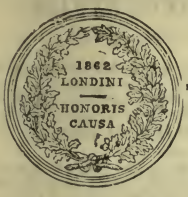

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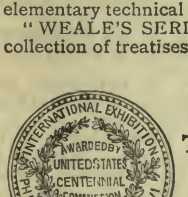

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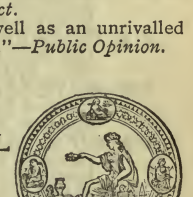

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